The OIL WEEKLY

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THE WEEK'S NEWS INTERPRETED

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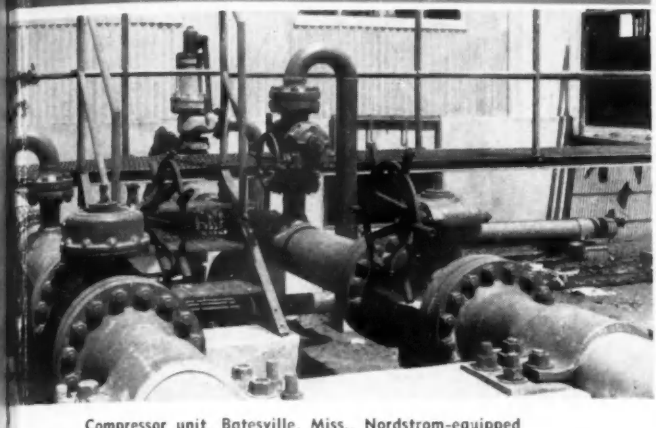
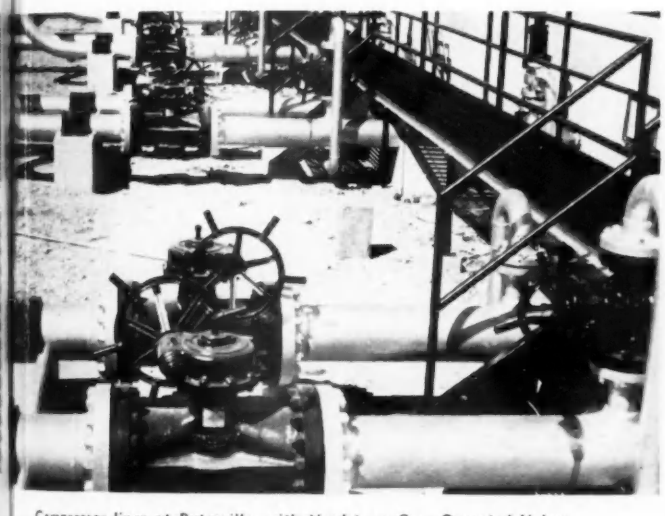
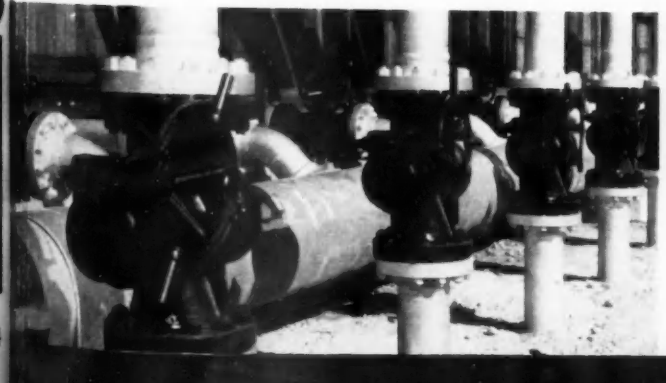


Compressor unit, Batesville, Miss., Nordstrom-equipped

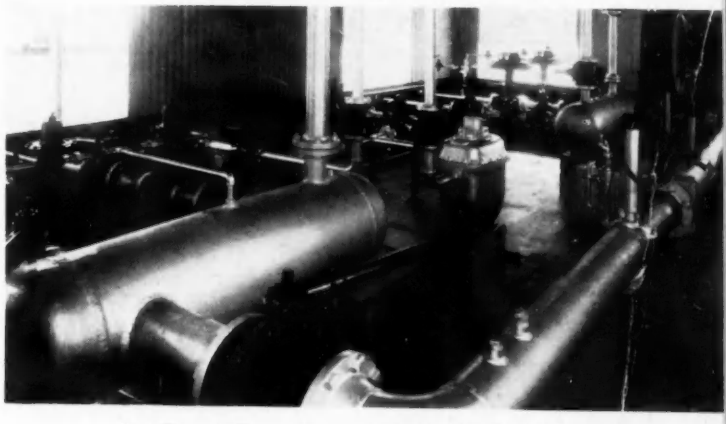


Compressor lines at Batesville, with Nordstrom Gear-Operated Valves



EMCO Orifice Meters on Tennessee station line

Nordstrom Valves on Tennessee transmission line



East Bernard, Texas, station showing EMCO No. 2½ Gas Meter

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ON A BEACH-HEAD

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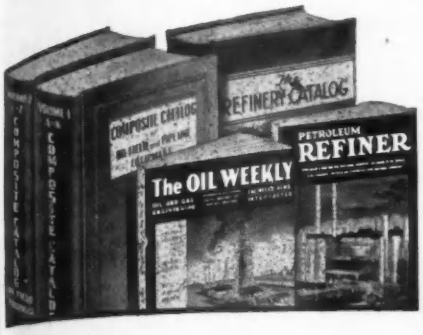

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THE OIL WEEKLY

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LOOKING AHEAD
... with the Editor

HOW well are the industry's operations meeting the current military and civilian needs? Are there any serious shortages of crude oil or refined products in any districts, and what are the prospects of supplying demand in the months ahead?

An article next week will analyze the industry's current statistical position and point out developments that loom ahead. Tabulated data will give the industry's record for the first 9 months of this year, compared with results in the like months of last year and 1941, last year before United States participation in the war.

The article will show trends not only for the nation but also for individual crude producing states and refining districts. It will bring up to date the comprehensive tables of the July 24 issue, pages 29-32, which covered the first half of this year.

ELECTRIC WELL LOGGING

Due to the volume presentation of the Tennessee Gas & Transmission Company's Texas-West Virginia line (pages 46 to 168, this issue), Part 13 of the Hubert Guyod series on Electrical Well Logging is being held over for next week when the series will be resumed. Part 13 deals with the electrical properties of oil-bearing reservoirs.

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CENSORSHIP NOTICE—Censorship rules occasionally make it necessary to tear out or otherwise delete parts of publications destined to subscribers outside the United States. If there be such deletions in copies of THE OIL WEEKLY going abroad, they are at the request of the Office of Censorship. Copies sent abroad face unavoidable delay because of time necessarily consumed in passing the publication through the Office of Censorship.—*The Publisher.*

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The Changing Panorama

Gag Used to Suppress Oil Pact Opposition

ACTIVITIES by some leading Washington officials last week as the Petroleum Industry War Council considered action relating to the proposed Anglo-American oil agreement has caused considerable talk. At first it looked like Ickes-Davies-Rayner et al had threatened to dissolve PIWC if it acted on a resolution pertaining to the oil pact, members being reminded that PIWC was set up not by law, but by voluntary act, and that it could be liquidated in the same manner. This later was denied.

But it cannot be denied that pressure of high degree was used to block action by the council in opposing the oil pact as written. It was a case of the gag expertly used to suppress the voice of a council, banded together to offer advice and suggestions in the conduct of the war—suppression of the fact that this group of practical and successful oil men, perhaps without exception, was opposed to the agreement which is pending before the United States Senate for ratification. Higher-ups didn't want the country at large to know that such unanimous opposition existed and they did the necessary shush-shushing.

Administrator Ickes' letter, printed in THE OIL WEEKLY last week, will bear study. Its true import is best gained by noting the words which were underscored and which, unfortunately, did not show in the telegraph version which was printed. Here is the way it appeared in the original:

"If the Council or any of its committees do so desire to record with me such views on the subject, I request that *at the same time* they make known their objections, they likewise make known in *specific language* exactly how, in their view, the existing document might be revised so as to remove the points of objection cited."

The PIWC comprises 72 members. As stated before, perhaps every man is opposed to the pact, but there are so many shades of opposition within the group that to ask them to revise in specific language "the existing document" and this within a relatively brief period, is suggesting the impossible. How long were the Anglo-American delegates in conference before they arrived at their agreement?

Making known their views as to the essentials of United States foreign oil policy and revising an existing document are two widely different matters. More than a year ago the PIWC Foreign Operations Committee set forth its general views on the question. That it had precious little influence on the formation of the existing document needed not be re-stated here.

But it is doubtful if this one job of suppressing true opinion by the oil industry's representatives will serve to wind up the matter. You know the old saying about truth crushed to earth rising again. From where we stand, it looks like it is going to take more than one blow—even though it was one directed by some high-up higher-ups—to wipe out opposition to the oil agreement. Despite Washington's studied efforts, Americans can be counted on to find a way of expressing themselves in a manner that will lead to the ultimate defeat of a measure that is so contrary to our way of thinking.

The oil industry has been aroused and as other lines of business wake up to the implications, they too will become articulate. A veritable avalanche of protest should descend on Washington as the Senate foreign relations committee opens its hearings. THE OIL WEEKLY's prescription and hope—is that this expression of true opinion will be so formidable that not even impervious bureaucrats will dare to resort to further use of the gag in order to kill it.

The pressing need in this nation today is a strong and independent Congress that will speak for all the people and which cannot be herded by any force—in or out of the White House.

SENATOR STYLES BRIDGES,
of New Hampshire

Truck Tire Situation Reported Improving

CHANCES of getting more tires for trucks have been improved substantially, although they will not be plentiful despite increased output. Production of heavy tires has increased 24 percent over August, as the War Manpower Commission succeeded in recruiting two thirds of the 11,500 additional workers it sought to add in September to the 70,000 employed in making tires and tubes. Less absenteeism and greater per man productivity were other factors that helped boost the output of heavy tires, no doubt resulting from the publicity which classed these as the No. 1 war bottleneck.

Another 4500 workers are scheduled to be added in February. However, not all of these will work on tires and tubes.

Says PIWC Without Postwar Authority

CHARGING that Administrator Ickes' request that the PIWC national oil policy show in definite language the changes that should be made in the Anglo-American petroleum agreement is a "presumption beyond the scope of the authority" of its members, Russell B. Brown, general counsel of the Independent Petroleum Association of America, last week challenged the authority of either Ickes or the PIWC to deal with postwar matters.

"Their functions should be concluded with the war," Brown asserted. "If there now remain war problems, their time and energies might more properly be confined to those problems."

Brown pointed out that members of the council have previously presented their views as to national oil policy to the administrator, and admitted that if the proposed agreement violates the principles so expressed they should so indicate. But, he added, "to require them at the same time to delineate line for line and word for word what they want in some proposed agreement is a presumption beyond the scope of the authority for which they were created.

"Such action might invite the recurrence of an unpleasantness quite familiar to those who remember the Madison case," he commented.

"Since the council can no longer be expected to take a strong, convincing position against this proposed oil agreement, the duty to intelligently and vigorously protest the approval of the present agreement falls upon the members of the industry," Brown declared in urging that the industry make its views known to the Senate foreign relations committee.

The American people have a tremendous confidence in our form of government. They believe in the capitalistic system—they believe in the making of profits. They think well of business and its leaders, and I do not believe that they dislike big business just because it is big. But the American people are certain to be very intolerant of management and labor alike if they seem to be creating such an atmosphere of pulling and hauling as to shake confidence in their value as leaders.

—WILLIAM L. BATT,
President SKF Industries, Inc.
in "Dun's Review"

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Sid Hodges-Drilling Superintendent
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Failure to Increase East Texas Production Creates Crisis

Texas Railroad Commission causes a dangerous drain on stocks and complex shift of pipe line runs to keep flow to Longview terminal of the Big-Inch up to requirements. Reason for acts not clear

By WARREN L. BAKER, Editor

FAILURE of the Texas Railroad Commission to allow the East Texas field to produce one more day per month, as it has been urged to do, has placed the nation's supply of petroleum in an extremely precarious position. Continuation of this policy by the commission, as in October and November, may soon even affect adversely the industry's war effort, by reducing below needs the amount of crude available to Texas Upper Gulf Coast refining plants making military products.

To assure a balanced crude supply for all refining needs, the commission in recent months has been asked to increase the allowable of the East Texas field, by permitting the field to produce one more day per month, which would mean 24 producing days in a 30-day month and 25 producing days in a 31-day month. The commission did not do this in either October or November. Instead, the commission granted allowable increases to numerous scattered fields, and because of pipe line limitations this was not the proper solution.

The problem is to make approximately 14,000 barrels of additional oil available daily at the mouth of the Big-Inch pipe line, so that refineries operating off this line can manufacture maximum quantities of military products and so that this can be done without disturbing the supply sources of Upper Coast refineries. Several controlling factors dictate that the East Texas field is the only logical source from which the additional oil can be obtained.

Pipe Lines Carrying Capacity

All main pipe lines delivering crude to the Longview Terminal from producing areas in West Texas, Southwest Texas, and Upper Texas Gulf Coast are operating at capacity and cannot physically deliver any additional crude. During the summer months these facilities transport crude at a higher rate than is possible during cold weather. This further reduces the amount of crude that can be moved to the Longview Big-Inch terminal from distant points during the winter months in order to fulfill the Big-Inch demand. Due to these physical facts, it is imperative that the additional oil be obtained from a source near the mouth of the War Emergency Pipe Line, and East Texas appears to be the only field that answers this phase of the question.

Furthermore, the East Texas field affords the only source of obtaining a substantial supply of additional sweet crude oil without exceeding maximum efficient producing rate. As of October 1, it is estimated that there were 21,860 barrels per day of additional oil available for production in the field without exceeding its maximum efficient rate. Other sweet crude that could be made available is limited to present volume because all the fields are producing or exceeding their maximum efficient rate of production, or do not have available facilities that can move the oil to Longview.

During the past several months a balanced supply for the Big-Inch has been obtained by reducing the amount normally supplied refineries in the Upper Texas Gulf Coast and by heavy draft on crude oil stocks in the East Texas district. East Texas stock districts are now below minimum working levels, and it is apparent that no more additional crude will be available from this source. The situation has become very grave. There just simply is not enough oil in storage to continue to make up the deficit in this way. Through the cooperation of several companies which have agreed to supply the needed quantity from storage and through additional oil available by switching refinery supply sources in a fashion remindful of a Rube Goldberg design, requirements will be fulfilled in November. However, December 1 seems to be the absolute limit, for there will be no stocks available to draw on after that date.

Stocks of crude oil located at refineries and pipe line terminals in District 3 have been reduced heavily since the first of the year, and now are critically low. Since the beginning of the year an average of 50,000 barrels daily has been taken from crude oil stocks located in District 3. Even in September, when the production allowable was the highest in history, withdrawals from storage were merely lessened but not stopped. In September, an average of 24,300 barrels was taken from the district's crude oil tanks daily; 13,000 barrels of which came from tanks of refiners and 11,300 barrels from pipe line tanks. During the first two weeks of October, the district's crude stocks dropped 14,710 barrels daily, although refineries in the district were running 91,000 barrels less oil to stills than the process schedule calls for. In November, due to the failure of the commission to furnish additional oil at the proper location, the draft on stocks is expected to be 16,700 barrels above what it would have been otherwise.

Refiners declare their stocks of crude are below safe minimum working levels. One coastal plant, which has been running at peak capacity, has but 6 hours supply of crude oil in its tanks, and this includes several grades. A pipe line company that has been helping to make up the deficit for benefit of the Big-Inch, has reported that it will even be shipping tank bottoms before the end of November. A breakdown in transportation, something that is occurring more frequently because too much oil is being crowded through the systems and pumps and prime movers cannot be kept in repair, would play havoc with the manufacture of war products, which are being lifted as rapidly as they are produced. In the Upper Texas Gulf Coast region alone, which is one of the principal refining centers of the world, an average of more than 24,000 barrels of crude oil daily has been diverted from steel tanks of pipe lines and refineries since the first of the year.

Mystery

The commission's failure to permit the East Texas field to produce one more day per month is a mystery to many oil operators, the majority of whom express themselves as believing this would not cause reservoir damage. They do not understand why the commission should be opposed to doing this. The commission attributes its policy to a decline in the bottom-hole pressure of the field, but this does not agree with the information of operators. Many have the feeling that some error has been made in the commission's bottom-hole pressure readings. The commission shows that between December, 1943, and October, 1944, a 6.5-pound decline took place in East Texas bottom-hole pressure, and that there has been a 10.68-pound drop since June of this year. On the other hand, bottom-hole pressure surveys made by an operators' committee, which tests four times as many wells as does the commission, reflects a 3-pound gain between December, 1943, and October, 1944, and no change between June and October of this year.

Most operators think that the field could produce the one additional day without damaging the reservoir. In this connection, and also in relation to the difference between bottom-hole pressure surveys of operators and the commission, operators point out that the average net fluid withdrawn from the field between January 1 and September 1, 1944, has been 96,140 barrels less per day than taken out during the year 1943. The total net withdrawal rate has long been considered by engineers, operators and the commission as the "key" to the field's bottom-hole pressure. During the year 1943, the average net fluid withdrawal per day was 644,628 barrels, and so far this year it has been 548,488 barrels. This decline in net fluid withdrawal rate has been due to the increase in water returned to the producing formation. Whereas only 201,706 barrels were injected daily in 1943, an average of 330,626 barrels has been injected in 1944, and the current rate is much higher. Oil production has changed but slightly, average 366,856 barrels daily for 1944 in contrast with 352,351 barrels for the year 1943.

All these figures make it just that much more difficult to understand why the commission will not let East Texas produce another day.

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WASHINGTON ROUNDUP

By BERTRAM F. LINZ, Washington Correspondent

WITH high administration officials engaged politically in other sections of the country, the Washington oil scene last week was quiet and is due to continue so until after the votes are in and the results evaluated.

High-Cost Operators Subsidy—The procedure whereby high-cost operators in low-cost pools will receive a subsidy of up to 35 cents per barrel was announced by OPA, to be based on the excess of the average direct operating costs of all producers in the pool plus a flat 60-cents-a-barrel allowance for overhead and capital expenditures over the maximum price of the pool.

Oil and Aviation—The vital importance of aviation to the oil industry, both as a market and as a tool for exploration and development was emphasized by Orville Harden, Standard Oil Company (New Jersey) vice president, before the Civil Aeronautics Board during hearings on postwar development of American aviation service.

Oil Pact Opinion—The Anglo-American agreement situation brought from Russell B. Brown, general counsel of the Independent Petroleum Association, the suggestion that the matter, involving postwar operations, is not one for either PAW or the PIWC, which are wartime agencies, and should be opposed before members of the Senate by oil men as individuals. (Page 35.)

Elk Hills "Auction"—The Navy has announced that it will "auction" off the crude to be produced from Elk Hills, estimated at some 6,800,000 barrels at a sale in San Francisco November 14.

Iran and Russia Differ—Refusal of the Iran government to grant oil concessions sought by Russia will not lead to any action by this government in the matter, and State Department officials said they would be satisfied if the whole question of Iran went over until after the war.

United Nations Oil Program—A United Nations oil program, involving all of the countries comprising that group, was disclosed to be in the making, based on the production, refining capacity, transportation facilities and other factors, details of which may be disclosed before the end of the year.

Oil Ceilings Upped—OPA on November 5 ordered upward adjustments in the ceiling for crude oil produced from fields located in Louisiana, Kansas, Oklahoma and Texas.

Elk Hills Production To be Sold at Auction

The Navy Department will hold a public sale in San Francisco November 14 of crude oil expected to be produced from the naval oil reserve at Elk Hills, offering approximately 6,733,260 barrels to come from the shallow zone and 72,560 barrels expected to be produced from the deep zones.

Oral bids will be accepted at the sale only from persons who have filed a written bid and a statement of their qualifications prior to the auction.

Since expanded production from the reserve was undertaken as a war measure, the Navy reserves the right to reduce or stop production at any time when it is no longer required for the national defense, and more particularly for the meeting of the critical need for petroleum on the West Coast to supply the armed services in the Pacific theatre.

New Oklahoma Production Rules to Be Considered

A meeting of Oklahoma State Corporation Commission officials and oil and gas operators will be held at Oklahoma City at 10 a.m., November 9, to consider a new set of rules for the production of oil and natural gas.

The rules have been in preparation for some months under the direction of operators and regulatory officials. Interested persons have been invited to attend the meeting and recommend modifications or additions.

Procedure Outlined for Payment of Subsidy to High-Cost Oil Operators

High-cost operators eligible for government subsidy will benefit on the basis of average costs for the pools in which their wells are located rather than the cost of their individual operations, it was disclosed by the Office of Price Administration October 31 in making public plans for the payment of premiums by Defense Supplies Corporation.

To be eligible for the subsidy, it will be necessary to show that (1) because of certain high-cost factors the ceiling price of a particular pool is below the average cost of production, and (2) the cost of production is not out of proportion to the output obtainable.

Pools already under the subsidary plan on the basis of average daily production of less than nine barrels per well are not eligible to apply for increases under the high-cost provisions. The maximum premium for high-cost oil will be 35 cents per barrel.

Both the procedure to be followed by producers in filing applications and the principles under which OPA will determine if the pools qualify were worked out by the price agency in consultation with the industry. The Stripper Well Industry Advisory Committees will assist OPA in putting the program into effect.

The procedure, laid down by OPA, is as follows:

1. The producer should write the Petroleum Price Branch of OPA, in Washington, giving name and exact location of pool which he wishes to qualify for the subsidy.
2. OPA will notify the appropriate Stripper Well Industry Advisory Committee of the name and location of the pool, and will obtain the names and addresses of all producers in the pool, to whom it will send copies of the OPA cost form.
3. All producers should complete the cost form without delay, and forward one copy to the Petroleum Price Branch.
4. If any producer is not clear with respect to any requirements of the cost form, he should contact his industry advisory committee, names and addresses he will have.
5. After cost forms are summarized by the Petroleum Price Branch, each producer within the pool and members of the industry advisory committee concerned will be notified of action to be taken, and the basis for it.
6. Where increases are made, they will be incorporated into the crude oil regulation by written order and made effective on the first day of the month following that in which it was determined that the application should be granted.

OPA officials explained that because of the difficulties in developing satisfac-

tory information on overhead costs and capital expenditures for a pool, an agreement was reached by OPA and the industry to use a flat figure of 60 cents per barrel as the total amount of such items for any pool applying for the premium.

OPA will figure the average direct operating costs other than those covered by the flat 60-cent figure from information given in cost forms filed by producers. These call for data on income from sales of oil and gas, direct operating costs, production and number of wells, for quarters for the four calendar quarters preceding application.

Amount of increase to be granted any pool will be the amount by which the sum of average direct operating costs of all producers in the pool in the last quarter for which costs are submitted and the 60 cents per barrel exceeds the existing maximum price of the pool. In no case, however, will an application be granted unless direct operating costs are equal to at least one third of the existing maximum prices before adjustment.

Example of Computation

Adjustments will be computed to the nearest cent per barrel, as shown by the following example:

Producer	Daily Production in Barrels	Total Direct Operating Costs
A (20 leases)	1,800	$1,300
B (1 lease)	500	400
C (9 leases)	900	700
	3,200	$2,400

Average direct operating costs per barrel	$0.75
Allowance for all other costs	.60
Total costs per barrel	$1.35
Existing maximum price per barrel	1.17
Amount of premium price increase	$0.18

OPA estimated that 70 percent of all oil wells in the country which produce 10 percent of the total output—in number approximately 280,000 in 800 pools—were covered by the original stripper-well subsidy plan which went into effect August 1. The new plan will cover the high-cost qualifying pools in the remaining 30 percent of the wells, which account for the major pecentage of the oil produced. No estimate has been made, however, of the proportion of these wells which may qualify on the high-cost basis.

Rules Consolidated

The regulations for the payment of the high-cost subsidy were consolidated with those covering the stripper-well premium in amendment 6 to revised maximum price regulation 436 issued by OPA November 3.

Incorporated in the new order is a provision that no pool discovered after January 1, 1944, will qualify for subsidy unless OPA specifically authorized premium payments, which was inserted because some of the stripper-well increases were allowed in blanket form covering one or more countries or even an entire state, and new pools which do not qualify by reason of production of nine barrels or more per day per well might adopt the increased over-all ceiling price unless restricted.

OPA also announced that some 20 pools will be added to the stripper-well subsidy list as of November 1, in an order which also will straighten out the situation in the Salt Creek field in Wyoming.

Under previous orders, production from the shale and first Wall Creed sands in that field have been given a subsidy of 35 cents per barrel, and oil from the Morrison sand a 25-cent premium. The new order will not affect Morrison production, which officials said is segregated, but will provide a payment of 20 cents per barrel of oil from the first, second and third Wall Creed sands and the shale, which is commingled. The greater part of the production, it was said, is from the second Wall Creed sand, heretofore not covered by the subsidy.

Aviation's Role in Development of World Oil Resources is Outlined

The American oil industry has a major stake in the postwar expansion of international air service by American aviation companies, the Civil Aeronautics Board was told last week by Orville Harden, vice president of Standard Oil Company (New Jersey). Not only does the industry see an important market in the aviation field, but it depends upon air service for the conduct of its foreign operations, he disclosed.

Harden pointed out that at the outbreak of the war, the direct investment of American capital in oil operations abroad amounted to $1,250,000,000—one fifth of the total United States direct investment abroad.

"Foreign oil sources have become increasingly important, so that today the underground reserves abroad actually exceed those in this country," he explained. "Americans have not only led this world-wide growth in a technical sense, but have been major contributors to the development of foreign oil production, refining and marketing. The over-all American participation in foreign petroleum trade in all its branches at the outbreak of the war was about 40 percent—more than that of any other nationality."

Although oil is being produced in substantial quantity in 34 countries, large areas have not yet been explored at all or only partly. As the world's need for oil increases, Harden said, the effort to find and develop more oil must intensify and "continued participation by Americans in this work will require expanded air transport facilities."

America's Stake

Emphasizing the magnitude of our stake in the international petroleum industry, Harden told the board that at the outbreak of the war Americans had under their operation about one third of the total foreign oil reserves, owned about 25 percent of the foreign refining capacity, and supplied 44 percent of all foreign oil consumption outside of Russia.

"American oil men will need air transport to all parts of the earth to compete successfully in the sale and marketing of oil in the postwar world," he said.

"The oil companies of this nation want to continue to supply products to the world aviation market and to expand their business in this important and growing field," he added. "Their opportunity to do so will be enhanced in proportion to the degree that world airlines are owned and operated by Americans."

Air transport also will be important in the movement of materials for American oil-company operations abroad, Harden said. Air service already has been used, "at a saving of months or perhaps years in time," to move critical material across mile-high Andes mountains for construction of a pipe line in Colombia, he explained.

"Oil has become one of the world's vital raw materials, one of the keys to any program for an increased standard of living," he concluded. "Oil is found in all parts of the world, and the peoples of all lands use oil products. Wherever there is oil you will find Americans, for Americans have taken the leadership in exploring for oil, in getting oil from the earth, in refining oil into its many human uses, in getting oil to market. The technology of oil and the sciences based upon oil—applied all over the world—are largely American in origin.

Aviation Important Element

"In attaining and maintaining this leadership, speed of communication and travel has been important as a routine matter. Air transport has been of tremendous help in providing this speed of communication and travel. The American oil industry has utilized to the fullest the air facilities available in the past, but as the world progresses, as new oil sources are opened up, as competition continues to increase, the industry's needs for international air transport to every corner of the earth will inevitably grow.

"Oil is a most important element of our national prosperity and is essential to our military strength. But the job of having plenty of oil, and specifically aviation products, available at points throughout the world where we may want to use them cannot be done overnight in response to a sudden crisis. To have such supplies of oil products available requires an active world-wide oil business with established sources and sustained outlets. American aviation activity will be an important element in the development and maintenance of such facilities at strategic points throughout the world."

Texas Well May Link Fields in Venezuela

Rincon Largo 3 of Texas Petroleum Company, in northern Anzoategui, Venezuela, was drilling at 7843 feet on October 24. This test is located midway between production in the Rincon and Santa Ana fields. The well is running several hundred feet low on structure.

Texas No. 2 wildcat, north of Tucupita, in Delta Amacuro, was drilling at 8771 feet on the same date.

Indiana Gas Line

The Federal Power Commission will hold a hearing late this month on an application filed by the Kentucky Natural Gas Corporation for authority to operate 6-inch transmission pipe lines leased from Universal Gas Company, running between Terre Haute and Martinsville, Indiana, and from the Unionville gas field to the connection with the pipe line of Public Service Company of Indiana.

Northern Ordnance Plans To Abandon Wildcatting

John B. Hawley, Jr., president of Northern Pump Company of Minneapolis and owner of Northern Ordnance, Inc., announced in Tulsa that his company is discontinuing further wildcatting and will devote itself to developing its proven and semi-proven properties. The announcement was made by G. S. Davidson, secretary-treasurer of Northern Ordnance, Inc., who said that while offices will continue to be maintained in Tulsa, principal headquarters will be in Minneapolis. H. L. Scott, who had charge of the Tulsa office, has resigned to become an independent operator, as has C. S. Sidwell, production superintendent, and R. H. Patterson, assistant superintendent for Texas.

Giles A. Penick, Jr., will continue in charge of land and lease department and other field operations will be carried on by the same staff including L. F. Browning for Woodbine area, North Texas; G. C. Griffin for Big Spring area of West-Central Texas; C. W. Lobaugh for Graham area, North Central Texas; Otto H. Wolfe, general field superintendent and William C. Bednar, consulting geologist and petroleum engineer.

Reasons for discontinuing its wildcatting campaign, described as the biggest ever undertaken by an individual operator and including 300 tests drilled in 16 states, were said to be increasing costs of drilling, difficulty of finding reasonably hopeful blocks to drill, advancing costs of operating wells, and relatively small recoveries when a discovery has been made so that "further wildcatting would not be profitable."

Records indicate that from February 1, 1943 until October 1, 1944, the firm had found gas or oil in 184 out of 305 test wells and had a wildcat ratio of 208 percent and an overall well average of 31.106 percent. Strikes include the Gage Dome in Montana as well as discoveries in Kansas, Oklahoma and Texas. The company will continue to operate its large Pennsylvania properties acquired earlier this year. Hawley is believed to have spent $10,000,000 in his wildcat operations.

West Edmond Now Leads Oklahoma in Production

The West Edmond pool of central Oklahoma last week stepped into first place as the state's leading oil producer, displacing the Oklahoma City pool which had occupied this top position since 1930. West Edmond took the lead November 1 when its daily oil runs totalled 44,400 barrels compared with 42,400 barrels for Oklahoma City. West Edmond should continue to lead as new producers are being completed at the rate of almost two a day.

The pool extends 11½ miles north and south and is 3½ miles wide, with the northern and southern ends of the field still undefined and the east and west sides only partly defined. On November 1 the pool had 212 producers, 126 active drilling operations, 31 derricks standing and 36 new locations spotted. With 157 drilling rigs in the field West Edmond has the largest concentration of rigs for any single field in the United States. The pool was discovered April 11, 1943, and up to November 1 it had produced 5,472,000 barrels.

Crude Oil Production in the United States

(Estimates compiled by The OIL WEEKLY. All figures indicate daily averages, in barrels.)

STATE OR DISTRICT	PRODUCTION IN WEEK ENDED November 4	October 28
Alabama	200	300
Arkansas	80,850	80,050
California	883,000	885,200
Colorado	9,300	9,600
Florida	50	50
Illinois	203,500	199,800
Indiana	13,100	12,550
Kansas	260,250	286,950
Kentucky	28,950	28,650
Louisiana	363,950	362,600
North	73,300	72,850
South	290,650	289,750
Michigan	48,200	44,300
Mississippi	49,300	49,050
Missouri	100	100
Montana	24,940	24,700
Nebraska	950	950
New Mexico	105,750	104,900
New York	13,350	12,850
Ohio	7,750	7,600
Oklahoma	360,000	347,350
Pennsylvania	38,250	38,100
Tennessee	35	35
Texas	2,132,800	2,133,350
Upper Gulf Coast	546,700	537,700
East Texas Field	369,400	371,350
Rest of Eastern Texas	146,700	149,500
Lower Gulf Coast	243,000	236,850
Southwest Texas	78,650	77,800
South Central Texas	19,950	19,750
West Texas	482,050	492,800
North Texas	150,200	148,800
Panhandle	96,150	98,800
West Virginia	8,650	9,100
Wyoming	100,850	99,450
Total United States	4,734,075	4,737,585

Seubert Retires as Head Of Standard of Indiana

A. W. Peake

Robert E. Wilson

Standard Oil Company of Indiana has announced several major changes in the top management of the company and its subsidiaries to become effective January 1, 1945.

E. G. Seubert will retire from the presidency after 52 years service, 15 as chief executive. He will remain a director and become chairman of the executive committee of the board.

Robert E. Wilson, president of Pan American Petroleum and Transport Company, will return to Chicago to become chairman of the board and chief executive officer of the Indiana company, and A. W. Peake, vice president, will advance to the office of president. His place will be filled by F. O. Prior, now president of Stanolind Oil and Gas Company. Prior will be a director and vice president of the Indiana company and will also be chairman of the board of the Stanolind Oil and Gas Company, Stanolind Pipe Line Company, and Stanolind Oil Purchasing Company as Peake has been.

Wilson will take over Seubert's responsibilities as chairman of the board of Pan American Petroleum and Transport Company, Standard's eastern subsidiary.

In addition to vice president of Standard of Indiana Prior will become chairman of the board of the Stanolind companies.

E. F. Bullard, executive vice president, will succeed Prior as president of Stanolind, effective January 1. Bullard, a Yale graduate, entered the oil business as a geologist for Dixie Oil Company in 1921. He was named director of Stanolind Oil and Gas Company in 1930 and executive vice president in 1935.

The reorganization is designed to relieve Seubert of the greater part of the responsibilities and burdens which he has carried and yet retain for the company the advantages of his long experience, his counsel, and guidance in executive management, the announcement said.

Wilson was graduated from the College of Wooster in 1914 and did two years of advanced work in chemical engineering at Massachusetts Institute of Technology. Standard of Indiana employed him in 1922 as assistant director of research, put him in charge of a new development and patent department in 1929, and made him a board member in 1931 and a vice president in 1933. He was transferred to Pan American in 1935 as its vice chairman and was elected president in 1937.

Peake started in the oil business in 1912, the year he was graduated from Stanford University. In 1916 he went with the Midwest Refining Company, control of which was acquired by the Indiana company in 1921. He has since been with the Indiana company and its subsidiaries and has been a director and vice president since 1930.

Prior is also a graduate of Stanford. Finishing in 1918 he entered the employment of Midwest. He has been with Standard of Indiana subsidiaries ever since Midwest was acquired and has been president of Stanolind Oil and Gas Company since its formation in 1930.

Companies Given Relief From Excess Profits Tax

The Treasury Department disclosed November 2 that several petroleum producing corporations have been given relief from excess profits taxes under the provisions of Section 722 of the International Revenue Code.

A report on allowances made during the fiscal year ended last June 30 showed that Trinity Gas Corporation, Dallas, sought an increase of its excess profits credit of $162,715 for 1940 and $159,398 for 1941 and was allowed increases of $36,524 and $148,922 for those years, respectively, resulting in reducing its excess profits taxes by $10,689 for 1940 and $74,703 for 1941 and in increasing its income tax for the latter year by $25,242.

Gibson & Jennings Drilling Company, Dallas, seeking an increase of $35,258 in its credit for a period ended April 30, 1941, was granted $12,699, resulting in a reduction of $4,252 in tax.

Marvel Oil Company, Kemmerer, Wyoming, seeking increases of $11,945 for 1940, $15,969 for 1941 and $15,293 for 1942, was granted its 1940 application in full and $12,069 for 1942 and $11,298 for 1942, resulting in a reduction in excess profits taxes for the three

years of $16,810, partly offset by an increase of $4,121 in income taxes.

Bay Refining Corporation, Saginaw, Michigan, seeking increased credits of $41,211 for 1941 and $22,338 for 1942, was granted $7,201 for 1941 and $8,855 for 1942, cutting its excess profits tax $6,692 and increasing its income tax $1,919.

Continental Corporation, oil property developers, Los Angeles, asked an increased credit of $57,158 for 1940 and was granted $48,563, reducing its excess profits tax by $6,926, and Drilling & Exploration Company, Inc., Los Angeles, seeking an increase of $213,795 for 1940 and $212,492 for 1942, was granted $132,665 and $174,356 for those years, respectively. Reducing its excess profits taxes by $111,787 for the two years and increasing its income tax by $25,850.

Gasoline Study May Result In Upped Civilian Rations

A determination whether any additional supplies of gasoline will be available for civilian use in the near future is expected to be reached within 30 days, Senator Lister Hill of Alabama was informed last week by Walter Hochuli, PAW director of distribution and marketing, in response to an inquiry regarding the possibilities of increased rations for traveling salesmen.

Hochuli emphasized that there is no difference of opinion between PAW and OPA as to the desirability of providing more gasoline for certain types of salesmen and technicians and indicated that when the supply situation permits, quick relief will be provided.

The question of supply is currently the subject of international discussions in conferences at which a United Nations oil program is being worked out, Hochuli said.

"At the present time and for the past two months," he explained, "our program division in PAW has been working with a similar group of men from Great Britain on the long term program for the United Nations. In this program there is considered the petroleum production of all of the United Nations, their refining capacity, their transportation facilities, and all matters involving the final availability and supply of petroleum for the military. These final figures are set against the military demands, and what is left is available for the civilians.

"It is hoped that this long-term world-wide program will be completed within the next 30 days, and at that time we will know whether or not there can be made available any additional supplies of gasoline for civilian use in this country. If so, you may be sure that we will promptly advise the OPA of the amount that can be made available and I know that that rationing agency will give prompt consideration to the distribution of this additional gasoline to those people who have need for it."

Alaskan Oil Plans

Work on the first oil well in the Navy's 35,000 square miles of oil reserves in Alaska, will start by April, according to Rear Admiral C. A. Trexel. A camp at Point Barrow is virtually complete, and will be in the nature of a permanent base. It will be occupied by 200 Seabees and naval engineers. The reserve area is about 175 miles east of Point Barrow.

Persian Refusal of Russian Bid for Oil Concessions Causes Discussion

The official Soviet Trade Union newspaper *Trud* has sharply attacked the policy of the Iranian premier and parliament in refusing to grant petroleum concessions to Russia covering a large area at the south end of the Caspian Sea. The article featured the opinion that Persia's action in refusing the concession was harmful to the Allied cause and to the people of Iran.

Likewise, the Soviet magazine *War and the Working Class*, discussing rejection of Russia's bid, cited American figures showing that United States companies control 57 percent of the world's petroleum reserves, Great Britain 27 percent, and the Soviet Union only 11 percent. Companies owning Persian and Arabian concessions have been inspired by the hope of dominating European markets and organizing low cost export enterprises yielding profits of up to 100 percent, the magazine said.

It also stated that the British are alarmed because cheap oil from the Near and Middle East would depress prices of the output from their Persian fields. The American government and the American oil industry, according to this magazine, are concerned over the possibility of greater production in Persia and Arabia for fear that South American oil would then lose its European market and Near Eastern oil would also flood the American domestic market.

Meanwhile, Russia's futile attempts to obtain oil concessions in Iran are being watched from the State Department with interest but apparently without concern. The United States, it was disclosed in authoritative circles, has no intention of going to the aid of the Russians in Iran.

At the same time, it was indicated the department will not press American interests in Iran until after the war.

A State Department spokesman pointed out that Iran generally has been regarded as a British sphere of influence, although Russia some years ago considered the northern part of the country as within her own sphere. It is in that section that the soviet government is attempting to secure concessions.

At a press conference November 2, Acting Secretary of State Stettinius admitted that the United States would be willing to see the question of Iranian oil go over until the war, and indicated that the Department would take no position with respect to Russia's attempts to obtain concessions.

Stettinius said that conversations with the Russians on the general world petroleum situation would be held, but that no date has been set as yet for any meeting.

Puzzle Continues About Russia's Ploesti Views

American and British oil interests were represented last week as seriously concerned over the failure of Russia, now occupying the Ploesti oil fields, to permit them to inspect their properties in that area, but uncertain as to what course to pursue to remedy the situation.

While the Russian government has not specifically refused to allow oil companies with interests in the field—Standard Oil Company (New Jersey) and British Shell among them—to examine heir properties, it was said, neither has it given any indication that it would grant such requests.

The State Department, apparently, was maintaining a waiting policy, with the hope that the question will be settled satisfactorily in the near future, with suggestions that this might come about at some three-power conference which might be arranged.

Ploesti Area Bomb Damage Greater Than Expected

A joint Allied military committee studying results of bombing in the Ploesti area has found that results were much more damaging than was previously believed from examination of aerial photographs. Refineries had been thoroughly wrecked, flying bomb fragments accomplishing much of the destruction. Structures which appeared from the air to have been only partly damaged were in reality ruined by fire, though they remained standing.

Ingleside Strike Vote Before Humble Case Heard

Developments last week in the attempt by the CIO union to force Humble Oil & Refining Company to accept the maintenance of membership clause as an addition to their Ingleside refinery union contract, placed Humble in an unfavorable position in its fight to maintain a non-discrimination policy toward workers whether members or non-members of any union.

It was revealed that local 316 of the Oil Workers International union (CIO) had requested the National Labor Relations Board for a strike vote by a bargaining unit, and that the board had set November 16 as the date for the vote. The union proposed to call the strike because Humble has failed to add the maintenance of membership provision to its bargaining contract. Officials of the company, including Hines H. Baker, vice president, met with all employes of the Ingleside plant Wednesday to acquaint them with the situation and checked to them the issue of whether they wish to interrupt production of vital war materials.

Early in September the company obtained an injunction from a federal district court in Dallas restraining the labor board and other government agencies from seizing the Ingleside plant to enforce the maintenance of membership provision, and hearing on the case subsequently was set for November 6 by the United States circuit court of appeals. This hearing has recently been postponed at the request of the government until November 22.

It has been pointed out that this postponement of the date of trial of the case on its merits has allowed the strike vote to be held prior to the trial. Should enough votes be cast in favor of a strike, it might well be construed as a labor

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disturbance under the Smith-Connally act and strengthen the government's position in enforcing the demands of the CIO.

When the original bargaining contract was signed, the maintenance of membership clause was left out with the approval of the regional labor relations board, inasmuch as there had been no labor trouble at the plant and such a provision would mean a departure from a long-established policy of the company.

Rig Builders to Organize In Mid-Continent Area

Organization of an association of rig-building contractors in the Mid-Continent area to study wage stabilization problems was promulgated at a recent meeting in Tulsa, Oklahoma. Lewis R. Keith of Russell, Kansas, was named chairman; A. J. Hoover of Tulsa, vice chairman, and Frank M. Mahan of Tulsa, secretary.

A resolution, unanimously adopted, requested the National War Labor Board to appoint a special rig-building panel with authority to investigate various practices with a view toward stabilizing these practices throughout the area.

The meeting was called for conference with A. Langley Coffey, regional attorney of the 8th Regional War Labor Board, Dallas, and Bernard Cushman, regional attorney for the 7th RWLB, Kansas City. Cushman was represented by his senior enforcement attorney, Mat W. Benton. Lester E. Smith, associate enforcement attorney of the 8th RWLB served as chairman of the conference.

Coffey and Benton outlined the responsibilities of the contractors in the wage stabilization program. Hoover read a letter he had written to Dr. George W. Taylor of the National War Labor Board on June 20, 1944, wherein he pointed out a number of unsatisfactory practices of the industry. A. R. Kinstley of Fort Worth, Texas, representing the Oil Workers International Union (CIO), discussed the attitude of his union toward the union contract and the working rules incident thereto.

The question of payment for time and one half for work over 40 hours per week when the employe worked for several different contractors during that period was discussed, it being contended such split time practice was in effect in certain areas prior to October 3, 1942, when rules and regulations of the stabilization program were set up.

Payment of room rent where workers are required to be away from home overnight is another widespread practice. Payment of travel time on both land and water jobs was discussed as was payment for short crews. Payment for "skidding" crews was found to vary, in some instances each move of a rig under such practice being considered a day's work regardless of the number of rigs so moved in any one day.

Of the 211 rig-building contractors in the 8th region—Texas, Oklahoma and Louisiana, only 63 have filed a Form 10 application requesting approval of wage rates established by the NWLB, it was reported. But it was revealed that all contractors were paying top rates with some bonuses of various kinds. Coffey and Smith informed the contractors that those paying rates in excess of what they paid on October 3, 1942, or those that had adopted premium rate practices not in effect on that date, without obtaining board approval, were in violation.

In discussing the "labor pool," Coffey expressed the opinion that where an employe during a work-week works for two or more employers who are entirely disassociated from each other, then the number of hours worked by the employe for any one of the employers, in so far as the Fair Labor Standards Act is concerned, may not be considered in determining hours worked for the other employer.

Where a contractor did not have regular employes, Coffey pointed out, and a regularly established work week, then such employes are considered casual labor.

The regional attorney declared that employes who knowingly accept pay in excess of what they are entitled are equally liable, as their employers.

Louisiana, Kansas, Oklahoma, Texas Oil Ceilings Are Adjusted Upward

Upward adjustments in the ceiling for crude oil produced in Louisiana, Kansas, Oklahoma and Texas were ordered by the OPA November 5, effective November 9. In all cases, it was said, the increases will be absorbed by the purchasers of the oil.

The OPA provided an increase of 20 cents per barrel on oil from the Lisbon Field, Louisiana, setting a ceiling price of $1.40 per barrel for all gravities.

An 11-cent increase is provided for Joes Lake and Silsbee fields, Texas, for which a ceiling of $1.36 per barrel was set for 24-degree gravity crude, with two cents deducted for each point under 34.

In Abell and Barnhart (Ordovician) fields, Texas, a ceiling price of $1.25 was fixed for 40-degree gravity, with a two cent deduction for each lower gravity degree down to 93 cents for oil below 25 degrees, an increase of 13 cents per barrel.

For 21 fields in Southern Louisiana, uniform ceilings are established at $1.30 per barrel for 40-degree gravity and over, with the customary differentials for crude of lower gravities. Four of the fields previously had a flat schedule of $1.19 per barrel for all gravities; four others had ceilings from $1.05 for below 31 gravities to $1.25 for 40 degrees, and the other 13 fields had ceilings ranging from $1.06 to $1.22 per barrel. The fields involved are: Avery Island, Barataria, Bateman Lake crude oil, Bateman Lake cycle condensate, Bay De Chene, Delacroix Island, Delta Duck, Delta Farms, Dog Lake, Erath, Fausse Point, Golden Meadow, Horshoe Bayou, Jefferson Island, Lake Salvador, Lafitte, Paradis, Plumb Bob, Stella, Vermilion Bay, and West Cote Blanche Bay.

Exceptions Cited

Two pools in Kansas and five in Oklahoma were excepted from the general spell-out of crude ceilings for those states which became effective October 3, and are now on the same basis as the Morel pool in Kansas, with ceilings from $1.01 per barrel for crude below 29-degree gravity to $1.25 per barrel for oil of 40 degrees and over, against former maximums of 83 cents for gravities below 20 degrees to $1.25 for 40 or better. At the same time, the October 3 order was revised by establishing the one ceiling of 85 cents for all crude below 21-degree gravity. The seven pools excepted from the general schedule are Dopita and Penny-Wann in Kansas, and Bald Hill, Edna Best, Pollyanna, Kellyville and Slick in Oklahoma.

OPA also announced four other changes in crude ceiling provisions as follows:

1. Ceiling prices for Pennsylvania grade oil were clarified by spelling out the ceilings at the receiving tank for six designated areas and establishing ceilings for other areas on the basis of prices in effect October 1, 1941, plus 25 cents a barrel. The six spelled-out ceilings, per barrel are: Bradford-Alleghany, $3; Southwest Pennsylvania, $2.65; Eureka, $2.59; Southeastern Ohio, $2.55; Zanesville, $2.25; Blue Rock, Niagara lime sand, $2.25.

"Operator" Now Term

2. So that the posted purchase price of October 1, 1941, for royalty oil cannot be used as a maximum price for operators, the term "Producer" is changed to "operator" in the sections defining posted purchase price and setting out the formula for determining maximum prices when specific prices are not established.

3. Where on October 1, 1941, it was the established practice in a crude oil pool to post the price for each gravity midway between each point of gravity rather than the general practice of posting for each full degree, and to adjust prices to the nearest cent for intermediate gravities, this procedure may be continued.

4. Where there are no pipe line gathering facilities in a pool under the stripper well premium payment plan, the maximum price for such pool is established at the price paid at the receiving tank on August 1, 1944, unless a higher price not to exceed the October 10, 1941 posted price is approved in writng by O. P. A.

Two changes were made in producers' dry and wet gas ceiling provisions, as follows:

1. Where an increase is granted by OPA in an individual or area ceiling price for dry gas used in carbon black manufacturers, or a new ceiling price for gas is established, ceilings of producers for other dry gas used in the manufacture of channel carbon black may not be automatically increased unless specifically allowed by written order of OPA. No increase made after June 30, 1944, will be allowed without OPA authorization regardless of the terms of any contract.

2. Sellers and purchasers have been allowed to set a tentative price for wet gas, taking into consideration value of the products extracted, condensed or saved. The scope is now extended so that consideration also can be given to any increase in the value of the extracted, condensed or saved product over the value existing at the time the contract was entered into.

Federal Technological Agency Will Be Pushed

Legislation adding an office of technological development will be pushed when Congress reconvenes, Senator Harley M. Kilgore, chairman of the Senate war mobilization subcommittee, has announced.

A new draft of the measure covers the expensive agency designed to stimulate scientific research and make new inventions available to industry, but the framework of the plan, to which many who testified at the subcommittee's hearings objected, has not been modified materially.

It is not expected, however, that any action will be taken until the subcommittee issues its report sometime this month, summarizing the experience gained during the war and the recommendations of leading scientists who have appeared before it.

PAW Personnel Changes; Sheets Takes Brown Post

Bettye Bohannon, for the past three years petroleum production and priorities analyst for PAW, has resigned to become assistant to the Petroleum attache at the United States embassy at Lima, Peru, with the distinction of being the first woman ever to hold such a post. Prior to joining PAW, Miss Bohannon was executive secretary of the California Conservation Committee from 1930 to 1941.

PAW also announced the appointment of Harold F. Sheets of New York, recently elected chairman of the board of directors of the Socony-Vacuum Oil Company, Inc., as a member of the petroleum industry foreign operations committee to succeed the late John A. Brown, for whom he served as alternate member from the time of the inception of the committee in December, 1941.

Company Changes Its Name, Rigs Up for Test in Egypt

American Eastern Petroleum Company, formed last July, has changed its name to American Overseas Petroleum Company. The company manages foreign exploration and development activities of companies jointly owned by Standard Oil Company of California and The Texas Company, with exception of their operations in Arabia and on Bahrein Island.

The first venture under the new operating arrangement is the wildcat well now rigging up west of Cairo, Egypt. Plans are also underway to conduct exploration and drilling in New Zealand, Australia, and the East Indies. E. A. Skinner is president of the company, E. M. Butterworth and F. C. Sealey are vice presidents, and H. G. Parker is secretary-treasurer, All are directors, in addition to C. E. Olmstead and J. H. MacGaregill. H. J. Hawley is exploration manager.

Texas Well Permits

Permits for drilling 98 new wells in Texas were approved by the Railroad Commission last week. There were 31 in Southwest Texas, 16 in North Texas and 15 in West Texas. The Gulf Coast reported 10 new locations, the Panhandle the same number of East Central Texas, 3.

T-G-T System Delivers First Gas

DELIVERY of natural gas from Texas to Cornwell, West Virginia, Wednesday, November 1, through the 24-inch line of Tennessee Gas & Transmission Company, marked formal completion of the project. Started December 4, 1943, completion of the line required three days less than eleven months.

The 1265-mile project was built at an approximate cost of $54,000,000. It traverses seven states and has a capacity of 207,000,000 cubic feet of gas daily. Engineers kept the line packed with gas at 800 pounds pressure, so that delivery was made possible at the West Virginia end, almost immediately after the final tie-in weld was made.

Principal source of gas for the line is in the Corpus Christi, Texas, district.

Farrand to Head Overseas Subsidiary of Companies

William H. Farrand will be transferred November 16 to San Francisco to become director and vice president in charge of production for American Overseas Petroleum Company, a subsidiary recently formed to develop foreign properties jointly held by The Texas Company and Standard Oil Company of California, exclusive of those in Saudi Arabia and Bahrein.

W. H. Farrand

Farrand, a 1922 graduate from Hamilton College, went to work for Romano-Americana, Roumanian subsidiary of Standard Oil Company of New Jersey, in 1923 but returned to the United States in 1927, entered the University of Southern California and received a Master's degree in Science.

He entered the service of The Texas Company as assistant petroleum engineer at Santa Fe Springs in 1929 during the deep-zone campaign. The next year he was transferred to Signal Hill in the same capacity. In May, 1931, he was promoted to superintendent and placed in charge of the Ventura district producing operations. Transferred to Los Angeles in June, 1938, he since has been superintendent in charge of drilling and production for the Pacific Coast division.

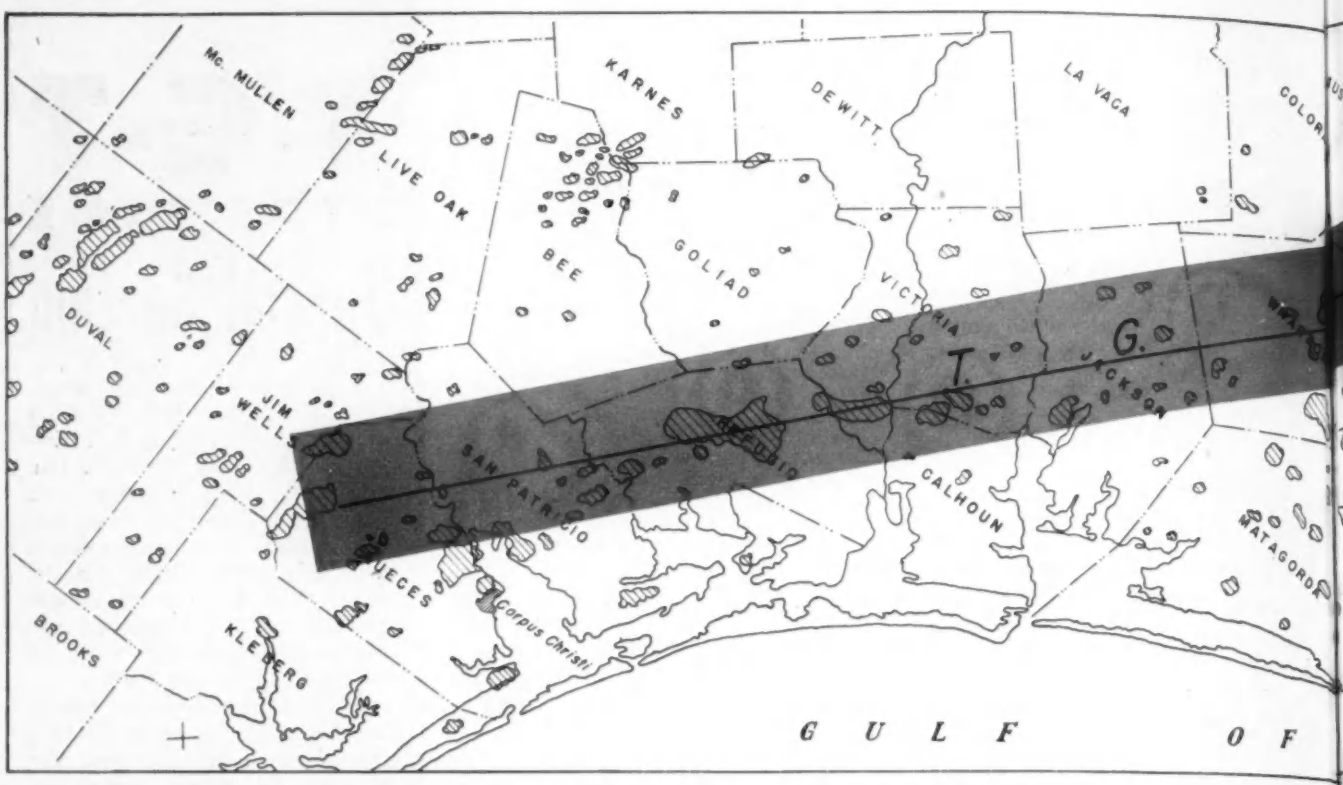
Indian Leases Offered

Sealed bids for oil and gas leases on 12,411.25 acres of restricted, allotted Indian lands in Caddo, Washita, Comanche, Cotton, Stephens and Tillman Counties, Oklahoma, will be received until 10 a.m., November 28 at the Kiowa Indian Agency, Anadarko, Oklahoma. The leases are offered for cash bonus in addition to the stipulated royalties and rentals of $1.25 per acre per annum.

T-G-T PIPE LINE Special Section

Beginning on the next page, The OIL WEEKLY tells the story of the Tennessee Gas & Transmission Company. How the line originated, why it bears the name of the state midway between intake and delivery points instead of either origin or destination, how the organization was perfected, the line designed and constructed, and the mass of wartime red tape snipped to enable the first delivery of gas in West Virginia to be made only 396 days from the time the official "Go Ahead" signal was flashed in Washington.

To give editorial coverage of this line from the start of right-of-way clearing to the final warm-up runs of the fifty eight 1000-horsepower compressors in 7 stations already delivering gas at the rate of 207,000,000 cubic feet per day to the Appalachian area's war industries, The OIL WEEKLY for months had editorial representatives out with the various pipelining spreads, in the various compressor stations, and following all phases of the work. Elton Sterrett, of the Houston editorial staff, carried his camera on travels aggregating 4500 miles over the line, and 91 of the illustrations in the pipeline stories testify to his ability to combine news and engineering angles in the views presented. Of the remaining photographs, and including the 9 in the section on "Personalities," 25 were made by Bob Bailey, of Houston, staff photographer for the T-G-T Company throughout the construction period, while thanks are due The Parkhill Truck Company for the other two giving a total of 118 pictures on this, the greatest gas pipeline project ever brought to a successful completion under conditions such as it encountered from the first.



Map showing relationship of oil and gas fields to Texas section of new Tennessee Gas and Transmission Company's line. Within ten miles on

Gas Transmission Lines Aid Natural

By providing means for moving natural gas to markets, pipe lines make possible the use of gas which otherwise is vented into air; thus effecting conservation

By E. O. BENNETT,
Houston,

ONE of the best known means for effecting conservation of natural gas in connection with the production of crude oil is to provide a suitable use or market for gas which would otherwise be vented. The value of gas accompanying oil production is controlled by two major considerations, one being its use as an agent in recovering the maximum quantity of oil, and the other, its sales value for use other than producing oil.

This discussion does not delve into the use of gas as a means of oil recovery, as its function in this capacity is too well known and understood by all prudent operators to require further analysis. The discussion will be centered on the second phase of the problem, a means of effecting the end use of gas now being legally vented under existing rules and regulations of the Railroad Commission of Texas.

Gas Must Be Piped

The only practical means for transporting gas to market is by means of pipe lines. Unlike crude oil, gas cannot economically be transported in "packaged" shipments. Since Texas industry and fuel consumption does not now provide an adequate market for gas produced with oil, there is a very limited use for such gas and the greater part of it finds its way to the atmosphere.

Much has been said about interstate pipe lines transporting gas out of the state, and that soon there would be none left for Texas consumption. Oil reserves, like gas reserves, are also being continuously depleted, and the major part of all the oil produced is consumed outside the state and not saved for future use in Texas. Yet no discussions are recalled where any reasons have been propounded for curtailing oil shipments out of the state.

Much Gas Vented

The accompanying map shows the section of Texas traversed by the new Tennessee Gas and Transmission Company's 24-inch line. The relative position of the oil and gas producing areas along the line are shown on the shaded area.

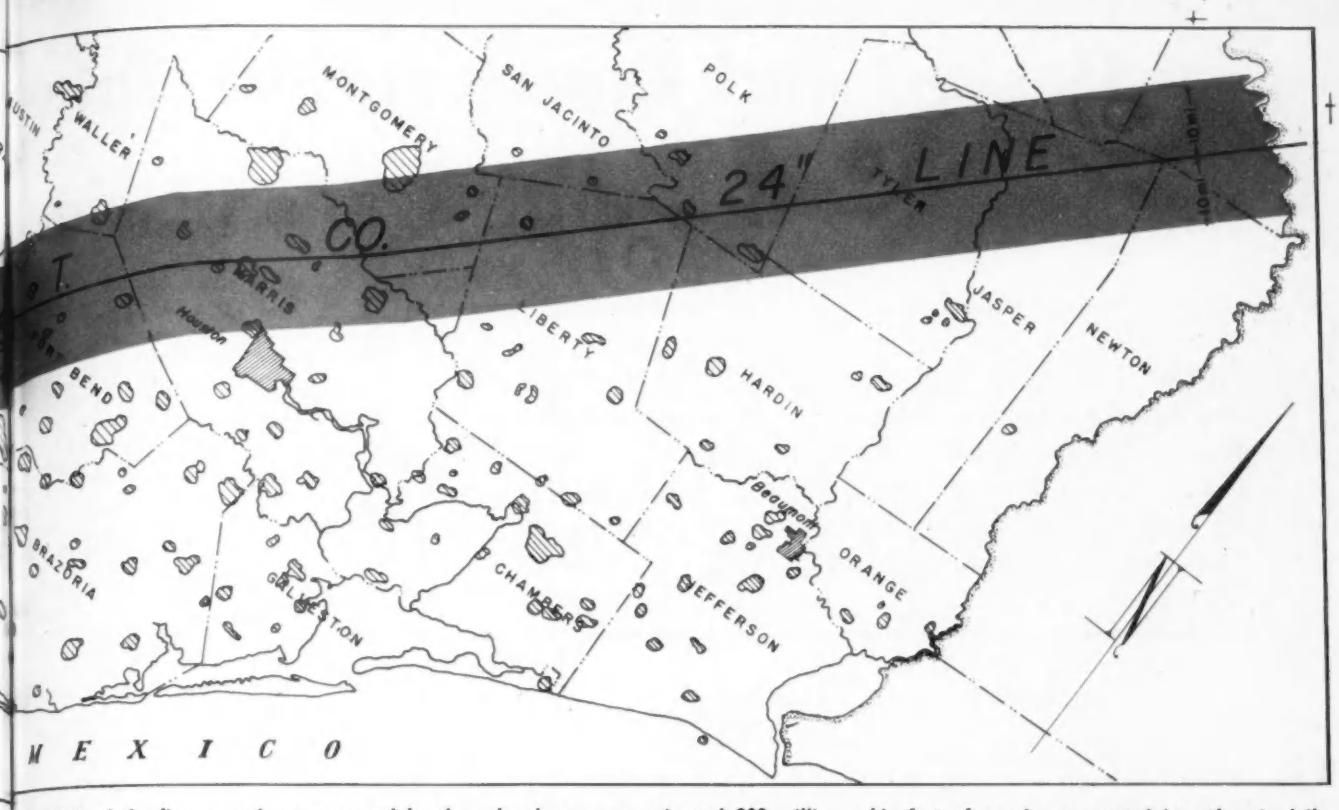
An analysis of gas-oil ratio and production reports filed with the Railroad Commission of Texas show that within an area 10 miles on each side of the gas line, almost 200,000,000 feet per day of gas is being legally vented and that outside this area and within practical reach of the gas line there is an even greater additional quantity of gas being legally vented.

Gas being vented per day within gathering distance is almost twice the maximum capacity of the gas line.

Space for More

Most of the large gas pipe line companies produce substantial quantities of gas from their own properties, approaching 40 to 50 percent in most instances. While Tennessee Gas and Transmission Company does not own any gas reserves, the underwriting commitment for reserves to support this line was taken by The Chicago Corporation, and these reserves which The Chicago Corporation owns should be afforded a measure of the market roughly comparable with that of gas pipe line companies which own their own reserves.

After such requirements had been



each side of the line, a region represented by the colored area, an estimated 200 million cubic feet of gas is now vented into the air daily.

Conservation of Important Resource

Besides putting vented gas to a useful purpose, pipe lines provide increased income to lease and royalty owners, and taxes for state and federal governments

Consulting Engineer,
Texas

satisfied, however, there would still be 100 million to 150 million feet of transportation space available for connections either to small isolated reserves or to oil fields where it would be possible to collect the residue now being vented in connection with oil production.

From the map it will be seen that even if its minimum obligations are undertaken in relation to its presently contracted gas, Tennessee Gas and Transmission Company's line could afford a market for a substantial quantity of the gas now being vented within the 10-mile strip on each side of the line.

It is assumed that the gas inside the 10-mile band is available in quantities of at least one million feet per day at gathering points at a pressure of 10 pounds per square inch. The cost of connecting such gas to the main system will include lines, dehydrators, compressors and proper control equipment. The estimated cost of connecting up the gas now being legally vented is $48,000 per million feet per day of capacity. Consequently, it will cost approximately $8,000,000 to connect up vented gas equivalent to 55 or 60 percent of maximum line capacity.

If the value of the gas at the well was 5 cents per thousand cubic feet, the cost of making the necessary connections to save and use the gas now vented would be equal to volume vented for approximately two and a half years.

Line Needed

With a facility for utilizing gas now being vented from the area along the pipe line, it can be seen that a major pipe line, such as that recently completed by Tennessee Gas and Transmission Company provides an adequate market for Texas gas production and also makes possible the use of low pressure lease gas, which at present serves no more useful purpose than to keep a large number of flares burning.

The economic value of a gas pipe line system for transporting gas to remote markets is that gas which cannot be used in Texas for lack of industrial load finds a market to provide current income to land and royalty owners and tax revenue for both state and federal governments, and also provides a means of conserving for useful purposes, millions of feet of gas now being vented under present Railroad Commission rules.

New and additional reserves of oil and vapor phase hydrocarbons, which are being currently developed, and the extremely large volumes of gas which will be available from existing cycling projects after the liquid hydrocarbons are extracted, will provide ample reserves for future use in Texas for all purposes including fuel, the manufacture of synthetics and plastics, and for conversion to liquid fuels by some of the processes now being developed. The increased value of gas made available by a major pipe line also provides an incentive for deeper drilling for gas which is quite certain to greatly increase known reserves.

Thus it can be seen that instead of rapidly reducing the total reserves of the state, a gas pipe line system actually can be the means of additional conservation with increased revenue to the communities through which it traverses.

Design and Construction Notes Gas and Transmission

Linking Texas Gulf Coast natural gas production and the Appalachian consuming region, the line benefits from unhampered ability to design and build throughout according to latest practices and developments. Its construction reflects advancements initiated by "Big Inch" lines and perfected for this big carrier

By ELTON STERRETT, Staff Writer

ORIGINALLY incorporated early in 1940 for the purpose of constructing, owning and operating a natural gas pipe line with intent to serve certain localities in the states of Tennessee and Alabama, Tennessee Gas and Transmission, a Tennessee corporation, filed its initial application for a certificate of public necessity on April 26, 1940. During the progress of hearings on this application, the need for additional fuel gas in the Appalachian area, coupled with diminishing reserves in that area, brought about an amended application in which the line as originally proposed was to be extended into West Virginia.

From this beginning, through numerous hearings and changes, evolved the line as now completed. On September 24, 1943, Chicago Corporation, having entered negotiations to develop a market for its unused gas production in Southwest Texas, found itself faced with the problem of setting up an organization for Tennessee Gas and Transmission Company, obtaining necessary personnel, ordering materials in advance of construction, planning and engineering, mapping, surveying and obtaining necessary right-of-way, and engineering the construction of 1,265 miles of pipeline before winter of 1944—approximately 365 days.

Organization

Gardiner Symonds, vice president of The Chicago Corporation, in charge of its oil and gas division, was chosen to manage the project and was elected president of Tennessee Gas and Transmission Company. He immediately drafted the services of Ray C. Fish from Stearns-Rogers Manufacturing Company as vice president in charge of engineering and construction; and transferred from the oil and gas division of The Chicago Corporation W. E. Mueller as vice president and treasurer, W. C. Norman as assistant secretary and assistant treasurer, R. G. Rice as assistant secretary, Harold Burrow as purchasing agent, George Mayes, as chief warehouseman and Charles S. Coates, who has functioned as one of the district and division superintendents. Later Binford Arney and C. C. Small, Jr., were borrowed from the firm of Small, Arney, and Small, state counsel, to head up the legal, land and right of way department, Arney as vice president and Small as manager of the land and right of way department. With this group as a nucleus, the newly formed Tennessee Gas and Transmission Company had begun to operate by October 1, 1943.

During October and November key personnel was selected for all departments. Fish acquired the services of J. P. Bristow as chief engineer and K. N. Fancher as pipeline superintendent, both formerly with Northern Natural Gas Company; Hiram Moore from Lone Star Gas Company as compressor station superintendent; G. H. McKay formerly consultant engineer for the office of war utilities of the War Production Board as assistant; Tod Pazdral, C. W. Smith, George E. Casey, B. J. Davis, Ed Erwin and W. E. Fahey as division superintendents in charge of inspection; E. N. Armstrong, N. D. Linger and many others well known in pipeline construction and to the gas industry.

E. C. Link, Jr., came from the Big-Inch as traffic manager; N. W. Freeman was hired as personnel director; Charles A. Lingo as assistant manager of the land department; and Marshall F. Lerch as chief expediter. These men came to the company during the months of October and November to handle many of the problems encountered in building a pipeline during wartime.

On August 1, 1944, as an important step in the transition period between construction of the pipeline facilities and the development of an operating organization, J. P. Bristow was made manager of transmission; William B. Poor, formerly supervising engineer for United Gas Pipe Line Company joined the company as chief engineer; Carl Myers formerly treasurer of Iowa Electric Light and Power Company joined the company as controller; and C. C. Hale formerly of Arthur Anderson & Company joined the company as head of the treasury department.

It was necessary that all phases of the work begin practically simultaneously and proceed without delay at the utmost possible speed. The major problems included surveying and mapping of the line over a territory involving widely divergent terrains, including the crossing of 67 major rivers and streams, many of which required special installations in the form of multiple line crossings, structures for carrying the line over above the stream, or adaptation of the line to permit it to take advantage of existing bridges.

Swamps and Hills

Approximately 700 miles of the line lay through forest and heavy undergrowth, 400 miles crossed rocky terrain, and many miles of dense swamp and flooded lowland had to be traversed. Once in the hills, the actual route had to be chosen to avoid abrupt ascents or descents to prevent pipe shifting and danger from landslips or constant exposure of the line through washouts.

The route of the line once selected, the land department was faced with the stupendous task of contacting approximately 12,000 landowners and, their consent to cross their properties negotiated for, to examine and clear title on these permits in 71 county seats in the 7 states crossed by the line.

Before October 1, 1943, within the first week of its initial effort, orders for all major materials for the project had been placed, while contractors for the construction of compressor stations, main line laying and installation of river crossings of all types had been selected by early November. On December 4, 1943, a ceremony at the site selected for crossing the Cumberland river in Tennessee commemorated initial construction on the program. On January 10, 1944, the first main line pipe was welded. Three weeks later, on January 31, the first compressor was shipped by the manufacturer, the last of the units not leaving the plant until July 20. The final tie-in weld, not far from the Buffalo river in Tennessee, and near Station No. 10 at Lobelville, Tennessee, was made on October 29, without ceremony and as just another routine bell-hole job. At the time of completion of the line welding, gas from the dehydration plant had been admitted to the line and an 800-pound test pressure built up to the point of the final weld. Initial delivery of gas was made October 31.

Engineering Design

The engineering design of the line embraces selection of the route and the design of all phases of the project. The system is designed to gather residue gas and to transport it first to a dehydration plant, then to the main line for forwarding east. Main features of the

And Observations on Tennessee Company's Pipe Line

design of the system are 1180 miles of 24-inch pipe, 85 miles of 20-inch pipe; 7 compressor stations with 58,000 installed compressor horsepower under the initial setup and 14 stations with 118,000 horsepower under the ultimate rating; a dehydration plant with maximum capacity of 300,000,000 million cubic feet; employe housing where required; and all other facilities for making the system a complete operating unit.

The design of the component parts is the result of detailed engineering calculations. These include determination of pipe size, its wall thickness, working pressure, number and location of compressor stations, and all other phases.

Designed to afford economic operation under present skip-spacing of compressor station, the system is laid out and all line and station pipe calculated to carry additional loading when conditions warrant the installation of present (and omitted) odd-numbered stations, requiring no change in facilities between tie-in points

The 24-inch pipe will operate under a maximum pressure of 750 pounds per square inch gauge; and the 20-inch pipe under a maximum pressure of 912 pounds pounds per square inch gauge. Operating at these pressures the safety factor of the pipe will be 1.4 on the yield point and 1.95 on the bursting strength.

The American Standards Association's code for pressure piping (gas and air piping), Division 2, states that pipe may be operated up to 80 per cent of the mill test. The Tennessee has required that all pipe be tested to 90 per cent of the yield point. Therefore, with the above specifications the pipeline was designed to operate at a maximum pressure of 72 percent of the yield point of the steel.

The War Production Board in an effort to reduce the steel tonnage required the pipe line to be constructed of a steel containing a high manganese content and a high yield point. However, due to the availability of manufacturing facilities they required that 300 miles of the 24-inch pipe and all the 20-inch be made in a mill in which the highest yield point available was 45,000 pounds and 900 miles of the 24-inch pipe made in a mill in which the yield point available was 50,000 pounds. The wall thickness, under Barlow's formula, is ¼ inch for the 50,000 yield-point and 9/32 inch for 45,000-pound yield-point steel, the 20-inch pipe with the lower yield point also being 9/32 inch.

That section of the main line using 20-inch pipe is designed for 912 pounds per square inch maximum operating pressure so that in case of an emergency and in anticipation of the ultimate design the full load of the line can be carried in this section.

The initial design of the pipeline system and the installation of the facilities for the presently contemplated throughput are such that to reach the ultimate capacity it will be a simple matter of placing additional compressors stations approximately halfway between those installed under the initial design.

Main Line Block Valves

The line is equipped with main-line size worm gear operated welded and lubricated plug valves installed at an average spacing of 10 miles. This spacing provides isolation of any 10-mile section for maintenance or repairs. The valves were selected to give an immediate and accurate shut-off under any

Specifications of the System

PRESSURES

Maximum Operating Pressure—24-inch	750 psi gauge
Terminus Pressure	475 psi gauge
Compressor Station Suction Pressure	400 psi gauge
Compressor Station Discharge Pressure	750 psi gauge

CAPACITY

Initial Design	207,000 MCF
Ultimate Design	262,000 MCF

CUBIC FOOT

Absolute Pressure	14.73 psi
Temperature	60° F. or 520° Absolute
Gravity	.60

PIPELINE
Welded Construction Throughout

Outside Diameter	24"	24"	20"
Wall Thickness	9/32"	¼"	9/32"
Miles	300	880	85
Minimum Yield Point	45,000 lb	50,000 lb	45,000 lb
Minimum Tensile Strength	70,000 lb	70,000 lb	70,000 lb
Bursting Pressure	1,641 lb	1,458 lb	1,968 lb
Yield Pressure	1,055 lb	1,042 lb	1,265 lb
Safety Factor on Yield Point	1.4	1.39	1.67
Safety Factor on Tensile Strength	2.19	1.95	2.62
Pipe Weight per Mile of Line—Tons	188.1	167.41	156.37

LENGTH—MILES

Main Line—24" Pipe	1180
Main Line—20" Pipe	85

COATINGS

	24"
Miles	1079
Coats of Primer	1
Coats of Enamel	1
Felt Wrapper	1

COMPRESSOR STATIONS

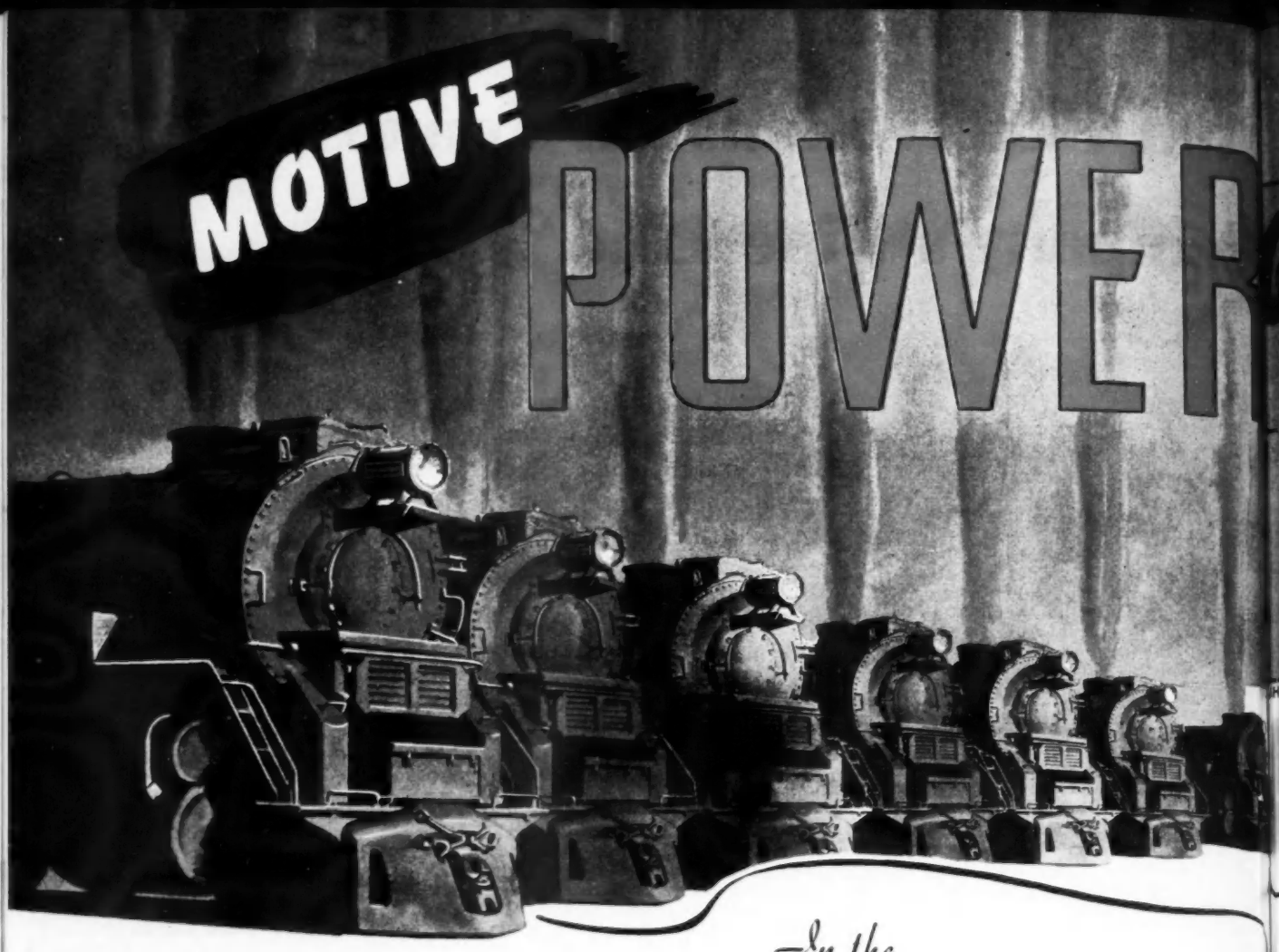
	Initial	Ultimate
Number of Stations	7	14
Spacing, Approximate Miles	170	85
Total Number of Units	58	118
Total Installed Horsepower	58,000	118,000
Compressor Ratio, Average	1.83	1.54
System Fuel Consumption per day (12 Cu. Ft. per Horespower Hour Operated) Peak Load Conditions (MCF)	16,704	33,984

GAS MEASURING STATIONS

Purchase Gas Stations	3
Check Meter Stations	3
Sales Meter Stations	3

MAIN LINE VALVES

	24"	20"
Type	Lubricated Plug Valves, with Welding Ends	
Average Spacing	10	10
Total to be Installed	141	8



In the
Tennessee Gas & Transmission Company project,
America adds a vital new resource to
her national wealth.

THIS SYSTEM delivers natural gas from Texas to West Virginia, augmenting present supply for war production and industrial use thruout several potent Eastern Seaboard states.

Think of the system as a single freight train, 1,265 miles in length. Its useful cargo is delivered at 750 lbs. pressure by seven Compressor Stations—the "Locomotives" without which the project lies inert and without meaning.

These seven Compressor Stations, at strategic points along the pipeline, employ fifty-eight 1,000 h.p. gas engine driven compressors plus twenty-one 400 h.p. auxiliary engines for generating electrical power—all taking their fuel out of the parent line. Each plant is self-contained, independent of outside sources for power, having its own water supply, sewage system, employee housing, etc.

The Stearns-Roger Manufacturing Company was assigned full responsibility for all Compressor Stations and for the Dehydration Plant. This included engineering, design, manufacturing and construction on a "Turnkey" basis. We are proud of that assignment.

We congratulate the Tennessee Gas & Transmission Company for its vision and ability to accomplish—so essential in a Nation moving forward to its rich heritage!

The STEARNS-ROGER

GIVES IT LIFE

Aerial view drawing of Compressor Station in Louisiana

The Dehydration Plant was designed and built to process the ultimate load of 300 million cubic feet of natural gas per day for introduction into the 24" main transmission line.

ERMFG. COMPANY DENVER, COLORADO

condition and to impose a minimum pressure drop through the valves. The valves, although nominally of main-line size, have a restricted area through the plug, but they are designed so there is a venturi effect to the flow of gas through the valves, thereby producing minimum pressure drop. Welded end valves were used to eliminate flanges, gaskets and alloy studs and nuts.

The valves, with watertight 7-foot gear extension, permit installation without the use of valve boxes. The valves were assembled and prefabricated to require a minimum of field welds. The weld between valve and field nipple was X-rayed before shipment. When presently critical materials and fabricating facilities become available the valves will be equipped with automatic shut-off devices.

Pipelining Innovations

The opportunity to design the pipe line from the start without regard to limitations imposed by existing facilities permitted the introduction of a number of variations from formerly accepted standard practices. In the clearing of right-of-way through wooded areas, for instance, extended use was made of a tractor-mounted circular saw. This odd-appearing unit was driven alongside the tree to be felled, the horizontally rotating saw on its adjustable vertical shaft was forced against the trunk, and in a short time trees were felled. As the unit advanced the saw blade into the wood it also maintained hydraulic pressure against a pusher arm which relieved the saw of cramping or binding as the cut deepened, also serving to fell the tree away from the tractor. In many instances a relatively shallow notch was cut into the tree opposite the point of saw entry, to reduce the possibility of seizing the saw in twisted fibres as the tree fell. The comparatively high stumps left by this method were more easily blasted from the ground than short ones left by axemen, due to the reduced splitting from the explosive charge and the retention of a firm anchor for the bull-dozer winch line.

Pressure Welding

The application of pressure welding to the first two pipelining spreads on the system afforded an opportunity to watch this development in autogenous joining of abutting pipe ends under heat and pressure. Two methods developed for handling the relatively thin-walled pipe assured contacting areas of full width, and reduced the inequalities occurring through handling misadventure. The pressure-welding method was used not only on straight joints of pipe, but also on the bent sections required to adjust the pipe to terrain inequalities, horizontal or vertical.

Wrinkle Bending

Development of two pipe-bending machines, differing in detail but basically similar in that each gripped a section of pipe and then, exerting a side pull through a block-and-tackle hitch, pulled the free end sidewise until a wrinkle bend had been set up across a restricted area. Spacing of these wrinkles at 15-inch intervals was adopted, to permit any degree of curvature to be put into the pipe without any too abrupt change in direction. Experience with the cleanout scraper through these wrinkle-bent sections failed to show any difference in handling over straight pipe.

On the electrically welded pipe, care was taken to see that the seam or bead did not come within the area distorted by formation of the wrinkle, though no attempt was made otherwise to orient the weld in the plane of least deformation. When arc-welding pipe, no attempt was made to align longitudinal welds in abutting joints; in the pressure-welding section usual practice was to align the two longitudinal welds within an inch or two, for uniformity in handling. This did not, of course, apply where either joint had previously been wrinkle-bent, only the desired angle of deviation of the line being considered.

Line Cleaning

The pipe line was thoroughly blown out after welding and tying into sections between the block gates. All pipe was swept or wiped clean by a man on a garage scooter before being tied into the line, and exposed ends were closed with tack-welded covers when left unguarded due to temporary stoppage of welding. The cleaning of the line was by means of special fittings, flexibly tied to the main line so that the pig or scraper could be placed in the line, the opening closed behind the device, and gas or air pressure built up to clean the section. A branch or Y- section, fitting into the gap in the line between two compressible couplings, closes the main and directs the flow of gas and dirt into the air. Due to the relatively short elapsed time between mill fabrication and welding of the line, only fibre bristles were used as cleaning agents on the scraper or pig, inspection of the pipe indicating the formation of relatively light rust coatings or a nature which could be removed without metal-to-metal contact. Any residual dust or rust particles remaining in the line would, of course, be trapped by the oil in the dust scrubbers in the compressor station installation, and the gas cleaned before being recompressed and forwarded.

River Crossings

A single, submerged crossing was used on the minor and less hazardous streams (those with low flood incidence records) in which cases the outside pipe diameter was retained but the wall thickness increased to ⅜ inch.

On navigable and hazardous streams multiple submerged crossings involved the use of three 16-inch lines with ⅜-inch wall thickness. Two such lines sufficed for the 20-inch stream crossings. Such submerged crossings, in addition to the standard primer, enamel coat and wrapper protection, received a second wrapping of felt, two more wrappings being cemented to the pipe at points where the river clamps were applied. On those streams where the line was dragged or towed across, the standard longitudinal shielding with strips of lumber was adopted, each section of shield abutting a river clamp and being restrained from slipping along the pipe.

On hazardous streams which lent themselves, by topography or otherwise to such design, aerial crossings, involving a single pipe of standard diameter were used. The welds on the line across the span between piers were enclosed in weld-reinforced sleeves, themselves welded to the pipe throughout their circumference. No wrapping was applied on exposed piping, instead a priming coat of metallic oxide and a finishing coat of aluminum paint being applied after the line was spaced in the supporting saddles.

Mississippi Crossing

The Greenville, Mississippi, highway bridge, lying near the route of the line, was selected for crossing the Mississippi river. Two 18-inch lines, one on either side of the structure, carry the gas across that stream. The 24-inch line divides before reaching the right-bank levee, crosses the levee as two 18-inch lines above the standard crest level in a sheath of compacted earth and gravel designed to withstand the erosion of flood waters. These two lines are carried in a trench through the flood plain until shortly before reaching the first span shore pier, rising one on either side to be supported across the structure in specially designed aluminum alloy structural forms attached to the bases of the spans. The rollers on which the pipe is actually supported are also of aluminum alloy, to hold added weight to the absolute minimum, as well as to minimize corrosion. After leaving the bridge structure just beyond the shoreward pier on the left bank, the line proceeds as two 18-inch fully-protected units until after the second levee crossing, when it again is manifolded to a single 24-inch pipe.

Compressor Stations

Each compressor station is a complete unit, with power plant, repair facilities, garage for storage of company and personnel vehicles, as well as the facilities for cleaning, compressing and cooling the gas. Houses are constructed at each of the stations, due to the fact that some employes are on 24-hour call, and because the distance from the nearest community is too great to rely on local transportation facilities for all crew members. Four houses are located at stations 2, 4, 8, 10, 12 and 14, with 2 at No. 6, and one at the dehydration plant. These houses are located within easy walking distance of the station, but well outside the high-pressure area and remote from the 24-inch main line. The houses are one-story, 4-room frame structures, with gas, water and electricity furnished from the station facilities.

Communications

Contact between stations and principal offices of the company is over a single talking circuit leased from the telephone company. There is installed a PBX termination at the main office of the company in Houston, with standard telephone terminations at each of the compressor stations, the Northern Division headquarters at Bowling Green, Kentucky, The Chicago Corporation office in Corpus Christi, the dehydration plant, each of the three delivery stations and at the toll bridge office of the Greenville, Mississippi, bridge. Local telephone service, connected to the nearest community exchange, also ties in the various compressor stations, the company office and the dehydration plant, permitting the establishment of emergency, toll, circuits in case of failure of the leased facilities.

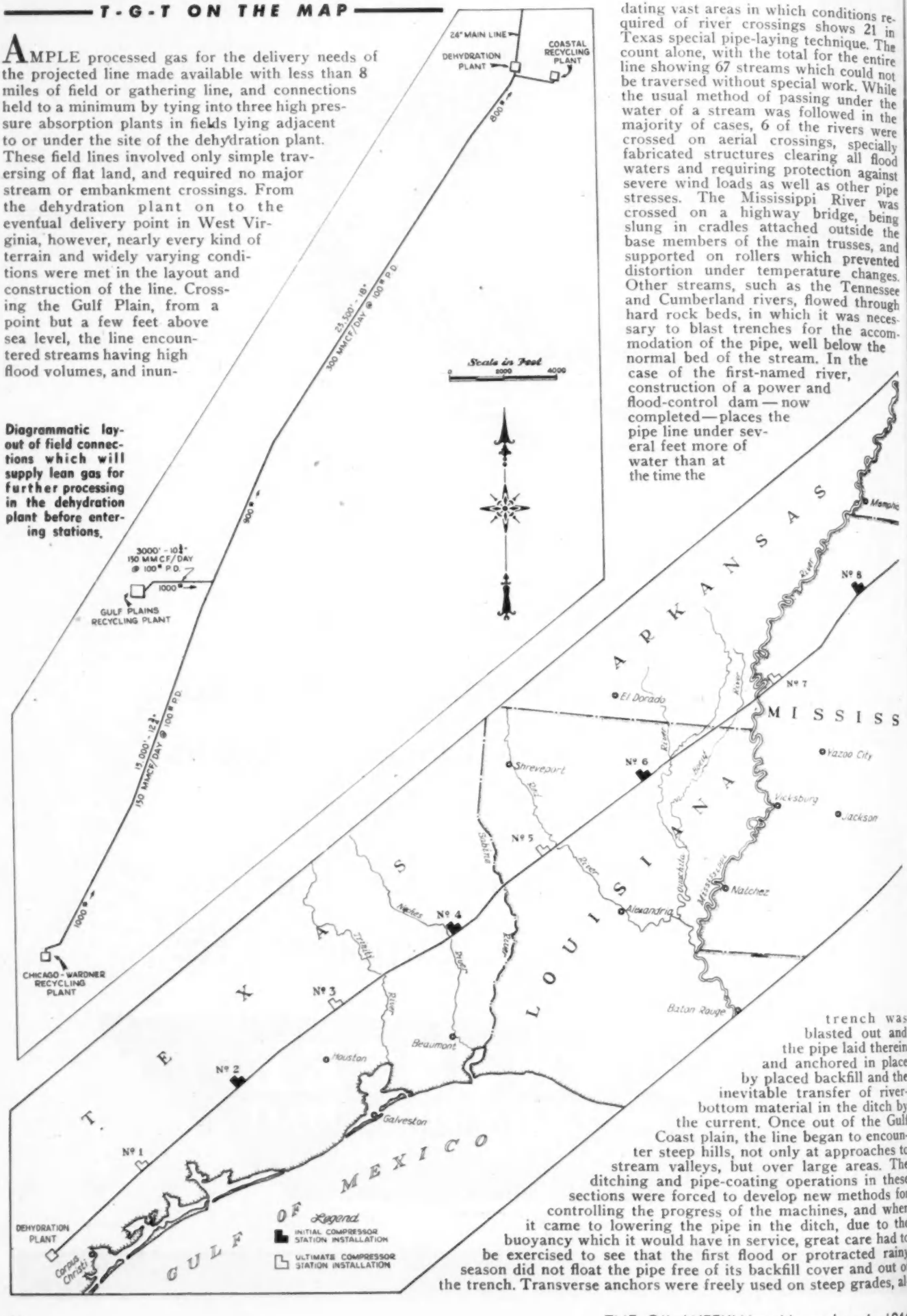
THANKS

The job is finished. We deeply appreciate the fine cooperation of all who participated in this wartime project.

TENNESSEE
GAS AND TRANSMISSION COMPANY
HOUSTON, TEXAS

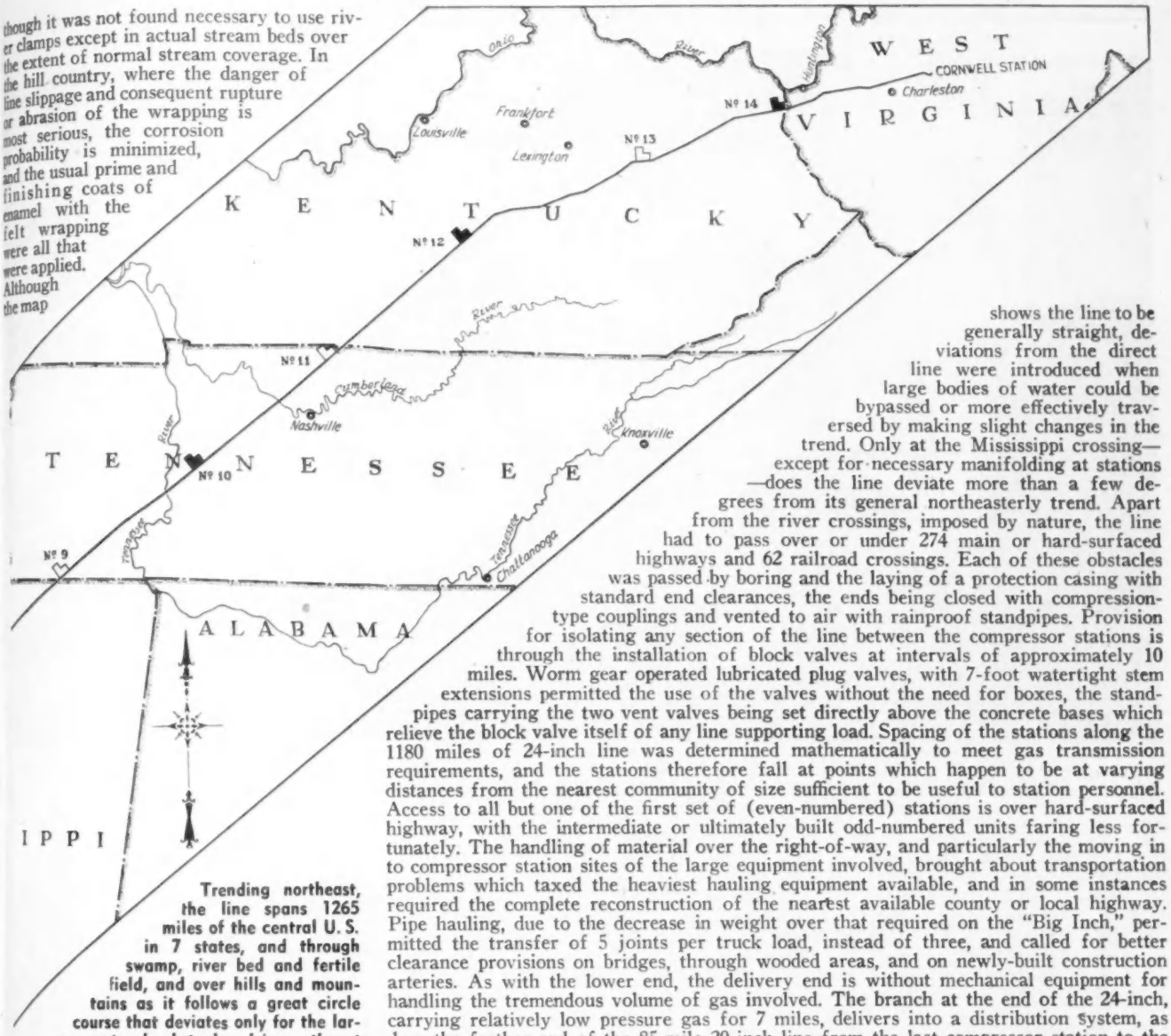
T-G-T ON THE MAP

AMPLE processed gas for the delivery needs of the projected line made available with less than 8 miles of field or gathering line, and connections held to a minimum by tying into three high pressure absorption plants in fields lying adjacent to or under the site of the dehydration plant. These field lines involved only simple traversing of flat land, and required no major stream or embankment crossings. From the dehydration plant on to the eventual delivery point in West Virginia, however, nearly every kind of terrain and widely varying conditions were met in the layout and construction of the line. Crossing the Gulf Plain, from a point but a few feet above sea level, the line encountered streams having high flood volumes, and inundating vast areas in which conditions required of river crossings shows 21 in Texas special pipe-laying technique. The count alone, with the total for the entire line showing 67 streams which could not be traversed without special work. While the usual method of passing under the water of a stream was followed in the majority of cases, 6 of the rivers were crossed on aerial crossings, specially fabricated structures clearing all flood waters and requiring protection against severe wind loads as well as other pipe stresses. The Mississippi River was crossed on a highway bridge, being slung in cradles attached outside the base members of the main trusses, and supported on rollers which prevented distortion under temperature changes. Other streams, such as the Tennessee and Cumberland rivers, flowed through hard rock beds, in which it was necessary to blast trenches for the accommodation of the pipe, well below the normal bed of the stream. In the case of the first-named river, construction of a power and flood-control dam — now completed — places the pipe line under several feet more of water than at the time the trench was blasted out and the pipe laid therein and anchored in place by placed backfill and the inevitable transfer of river-bottom material in the ditch by the current. Once out of the Gulf Coast plain, the line began to encounter steep hills, not only at approaches to stream valleys, but over large areas. The ditching and pipe-coating operations in these sections were forced to develop new methods for controlling the progress of the machines, and when it came to lowering the pipe in the ditch, due to the buoyancy which it would have in service, great care had to be exercised to see that the first flood or protracted rainy season did not float the pipe free of its backfill cover and out of the trench. Transverse anchors were freely used on steep grades, al-

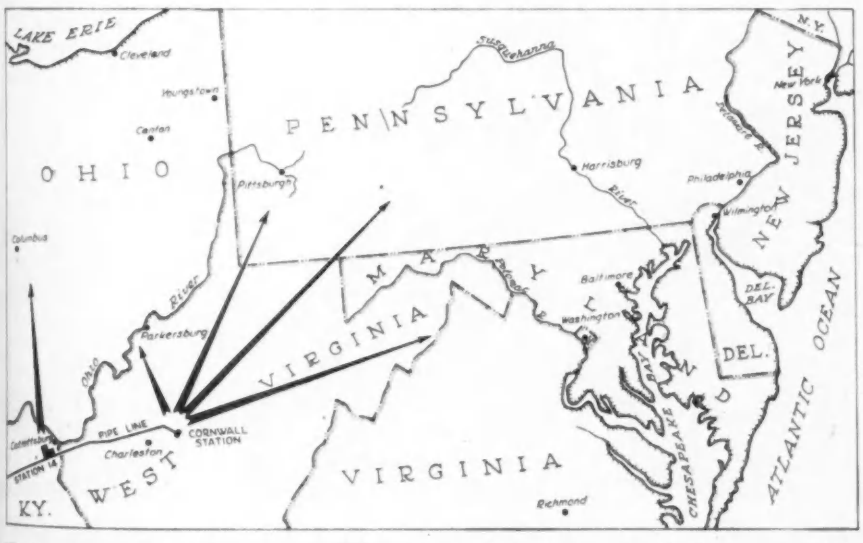


Diagrammatic layout of field connections which will supply lean gas for further processing in the dehydration plant before entering stations.

though it was not found necessary to use river clamps except in actual stream beds over the extent of normal stream coverage. In the hill country, where the danger of line slippage and consequent rupture or abrasion of the wrapping is most serious, the corrosion probability is minimized, and the usual prime and finishing coats of enamel with the felt wrapping were all that were applied. Although the map shows the line to be generally straight, deviations from the direct line were introduced when large bodies of water could be bypassed or more effectively traversed by making slight changes in the trend. Only at the Mississippi crossing—except for necessary manifolding at stations—does the line deviate more than a few degrees from its general northeasterly trend. Apart from the river crossings, imposed by nature, the line had to pass over or under 274 main or hard-surfaced highways and 62 railroad crossings. Each of these obstacles was passed by boring and the laying of a protection casing with standard end clearances, the ends being closed with compression-type couplings and vented to air with rainproof standpipes. Provision for isolating any section of the line between the compressor stations is through the installation of block valves at intervals of approximately 10 miles. Worm gear operated lubricated plug valves, with 7-foot watertight stem extensions permitted the use of the valves without the need for boxes, the standpipes carrying the two vent valves being set directly above the concrete bases which relieve the block valve itself of any line supporting load. Spacing of the stations along the 1180 miles of 24-inch line was determined mathematically to meet gas transmission requirements, and the stations therefore fall at points which happen to be at varying distances from the nearest community of size sufficient to be useful to station personnel. Access to all but one of the first set of (even-numbered) stations is over hard-surfaced highway, with the intermediate or ultimately built odd-numbered units faring less fortunately. The handling of material over the right-of-way, and particularly the moving in to compressor station sites of the large equipment involved, brought about transportation problems which taxed the heaviest hauling equipment available, and in some instances required the complete reconstruction of the nearest available county or local highway. Pipe hauling, due to the decrease in weight over that required on the "Big Inch," permitted the transfer of 5 joints per truck load, instead of three, and called for better clearance provisions on bridges, through wooded areas, and on newly-built construction arteries. As with the lower end, the delivery end is without mechanical equipment for handling the tremendous volume of gas involved. The branch at the end of the 24-inch, carrying relatively low pressure gas for 7 miles, delivers into a distribution system, as does the farther end of the 85-mile 20-inch line from the last compressor station to the intake of the plant of the purchasing company which compresses the gas anew and forwards it to markets in the West Virginia-Pennsylvania area covered by the arrows radiating from the terminus at Cornwell Station. Due to the intricate network of gas-transmission lines built and operated by competing companies in the area tributary to the East Ohio-West Virginia natural gas fields, it is impossible to do more than indicate the general trend of gas distribution after it leaves the main of the transmission company and becomes a part of the flow through the interconnected distribution systems. Through the connecting lines Texas gas, in common with Texas crude, reaches points of utilization more than 2000 miles from the wells and, in the case of the gas, at a speed of delivery which outstrips all but airplane delivery of commodities. The gas through the system will have a normal speed of around 45 miles per hour, or an elapsed time between dehydration plant and delivery at Cornwell Station of only 28 hours. Pressures along the 1265 miles of pipe, with all units in each station operating at capacity, will range from the maximum discharge manifold reading of 750 pounds, to the intake value of just above 400 pounds. Thus the line, when operating, will be charged throughout its length, with gas at an average pressure of nearly 600 pounds, and will contain sufficient gas to meet the power requirements of some of the smaller cities.



Trending northeast, the line spans 1265 miles of the central U. S. in 7 states, and through swamp, river bed and fertile field, and over hills and mountains as it follows a great circle course that deviates only for the larger natural obstacles lying athwart its path. Until it nears its end, the line passes near no large cities.



The immense manufacturing area served by companies into whose mains the T-G-T gas will be directed at the West Virginia terminal is indicated on this map, with the arrows showing the general direction in which most of the flow will tend. The estimated throughput will enable continued operation of many critical war plants on natural gas instead of facing a fuel change.

Not every time was the surveyor as fortunate in finding dry footing as was this one—nor as hapless as the rodman armpit deep in the muck of the swamp beyond as the line was carried across Texas plains, Louisiana swamps, the floodlands of the Mississippi and over the hills of Tennessee and Kentucky. Close ground checking followed preliminary aerial surveys in determining actual route.

Much of the line lay through timbered country and here, again, the trend was away from the use of man- and hand-power when possible. Clearings such as this were made with a tractor-mounted circular saw, which, sidling up to a tree, made the cut and at the same time shoved with a heavy hydraulic ram so that, when the cut was completed, the tree was felled where desired. Stumps such as those shown are more easily removed by blasting than those with shorter aboveground portions, as the tendency to split is lessened and the explosive force utilized to lift the stump as a unit. Solid stumps were more readily pulled by a tractor than splintered sections.

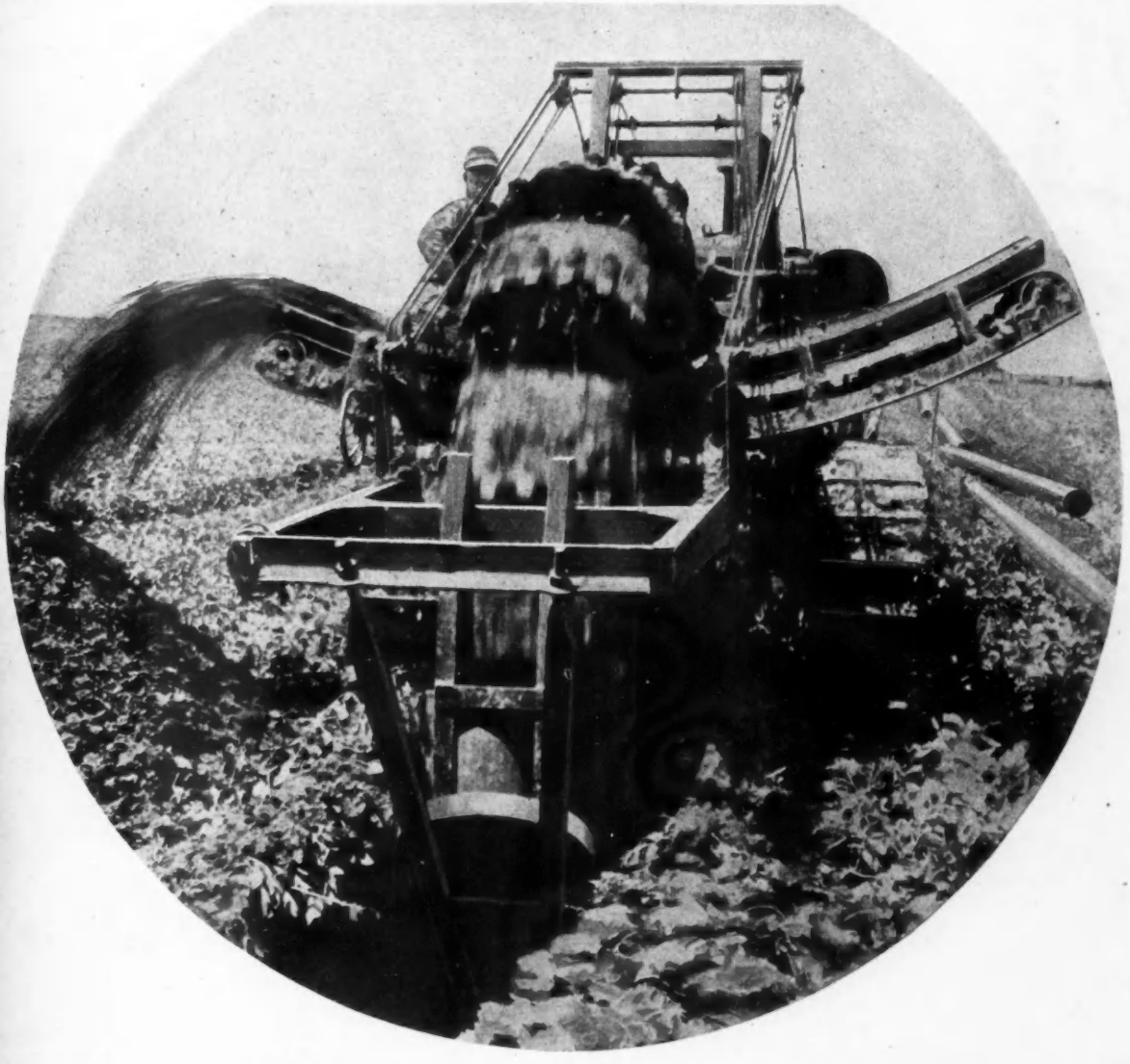
on the T-G-T

24 INCH GAS LINE

from Texas to West Virginia

CLEVELANDS

Peak Performance Continues



Cleveland ditchers' and backfillers' performance on this gigantic project was, as usual, up to the high standards pipeliners regularly demand and expect of CLEVELANDS.

BROWNING-FERRIS MACHINERY CO.

The Largest Contractor's Equipment Company in the South

HOUSTON DALLAS

Hard rock hills, without sufficient topsoil to accommodate the pipe trench, were perforce ditched by the use of hand-operated air drills, supplemented by blasting. This rough going, on a Kentucky hill, was so steep that logs were let into notches cut into the trench walls and the pipe secured to them to prevent slipping and possible cramping before the rock fill became consolidated.

Although the trench actually occupied by the pipe was cut to a width of only 3 feet, it was necessary to clear a right-of-way ample for a trunk highway before pipelaying could begin. There was required space for the spoil piled up by the ditching machines, a safe margin on that side of the ditch, then room for stringing pipe, passage along the line with the welding and coating spreads, and at the same time, cleared space for shuttle traffic between the ditching and backfill spreads. Here two tractors cut a shoulder and widen the shelf thus formed by side filling to give a broad, uniformly graded work without abrupt transitions between slopes.

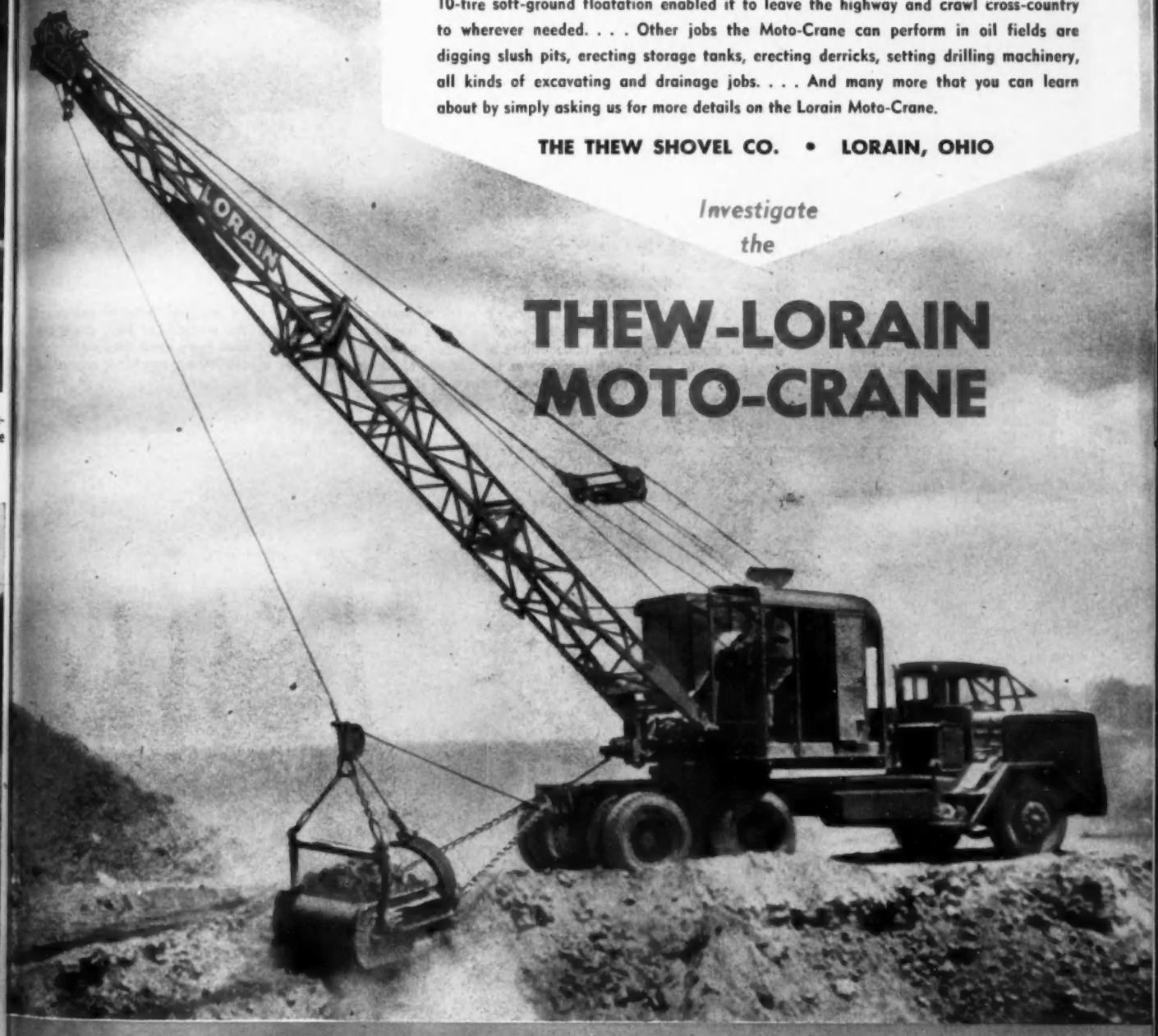
on the T-G-T
24 INCH GAS LINE
from Texas to West Virginia

Lorain Moto-Crane mobility and versatility played a part in the construction of this new pipe line. Among the jobs of this 20-ton crane were unloading pipe, handling pipe to cleaning and wrapping machines, stringing pipe, setting and bending pipe, digging gate holes, setting gate valves and risers. Because of its rubber-tired mobility it served many different jobs strung out along many miles of this job. . . . In high speed it hustled from job to job over highways at 30 M.P.H. . . . Its front wheel drive and 10-tire soft-ground floatation enabled it to leave the highway and crawl cross-country to wherever needed. . . . Other jobs the Moto-Crane can perform in oil fields are digging slush pits, erecting storage tanks, erecting derricks, setting drilling machinery, all kinds of excavating and drainage jobs. . . . And many more that you can learn about by simply asking us for more details on the Lorain Moto-Crane.

THE THEW SHOVEL CO. • LORAIN, OHIO

Investigate the

THEW-LORAIN MOTO-CRANE



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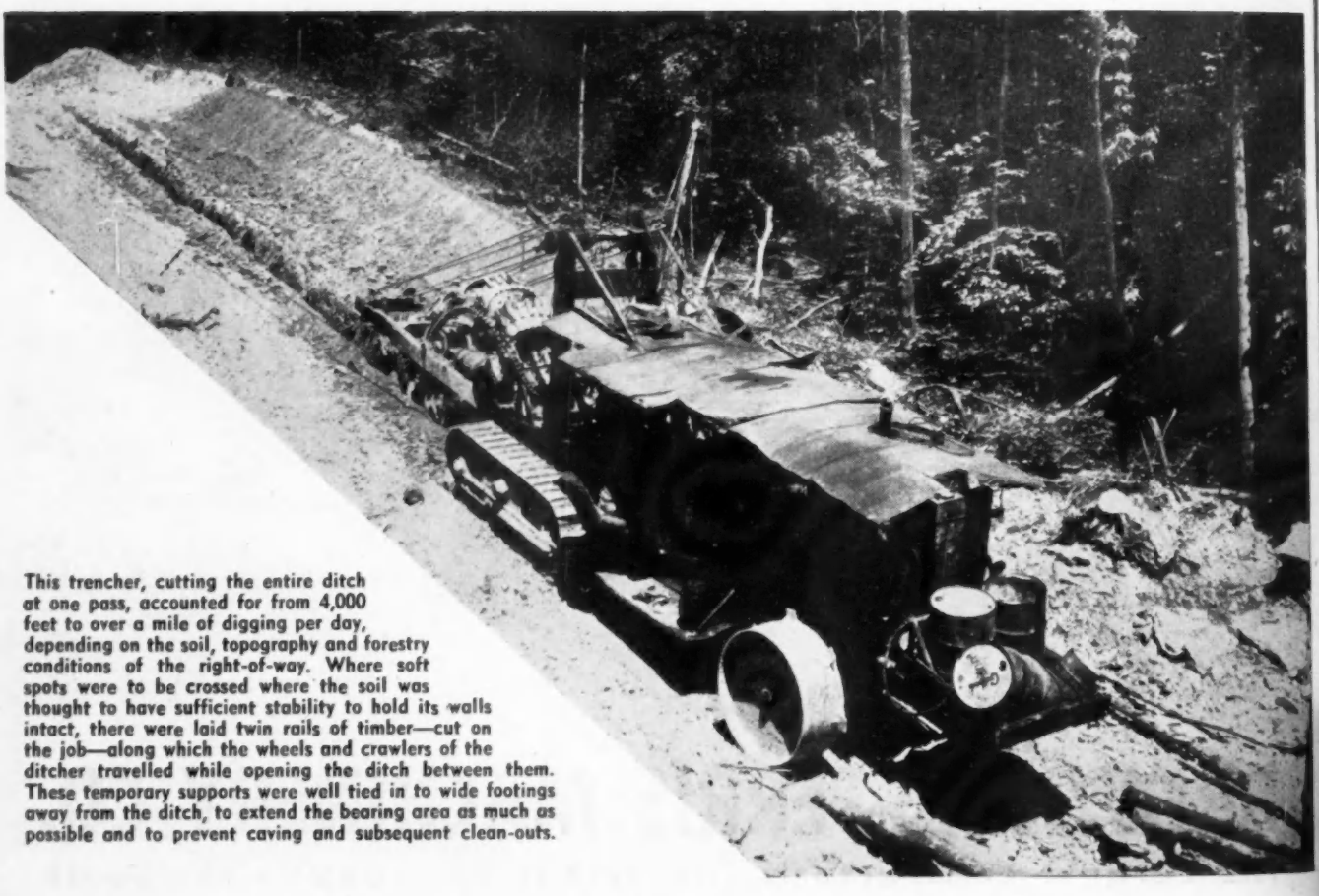
The Largest Contractor's Equipment Company in the South

HOUSTON **DALLAS**

The pipe required a trench 6 feet in depth and 3 wide, or an average of 2 cubic yards of earth removed for every yard of forward progress. On some sections of the line a deviation from usual ditching practice was followed in which one ditcher, following the staked-out line, cut a trench which went through the hardpan topsoil and, in wooded sections, removed the interlaced mattress of roots which slow down most digging operations in such terrain. This initial ditcher threw up a pile of earth which served as toe for the spoil excavated by the following machine, and aided in preventing the rolling of clods into the trench as it was completed.



This trencher, cutting the entire ditch at one pass, accounted for from 4,000 feet to over a mile of digging per day, depending on the soil, topography and forestry conditions of the right-of-way. Where soft spots were to be crossed where the soil was thought to have sufficient stability to hold its walls intact, there were laid twin rails of timber—cut on the job—along which the wheels and crawlers of the ditcher travelled while opening the ditch between them. These temporary supports were well tied in to wide footings away from the ditch, to extend the bearing area as much as possible and to prevent caving and subsequent clean-outs.

on the T-G-T

24 INCH GAS LINE

from Texas to West Virginia

Ingersoll-Rand

MOBIL-AIR COMPRESSOR

On this important project as on most major construction jobs you will find Ingersoll-Rand compressors, rock drills and air tools doing their part to get the job done "on schedule" . . .

The durability, stamina, and the easy operation and maintenance of Ingersoll-Rand equipment, combined with lower operating costs and higher efficiency give you new standards of performance.

BROWNING-FERRIS MACHINERY CO.

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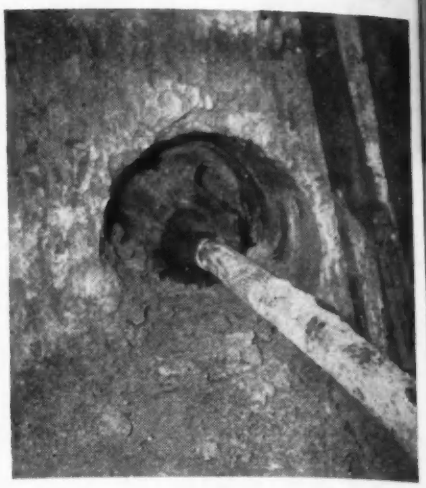
HOUSTON DALLAS



Railroad and paved highway embankments were pierced for the line by use of the machine shown at left. Mounted on skids and guided by flanged timber tracks pegged to the trench bottom, the driving unit powered a horizontal shaft through a reduction gear and turned a bit of a diameter sufficient to afford minimum clearance for the 28-inch casings used. Forward motion of the boring machine was provided by the winch line of an anchored truck, through snatchblocks and deadman anchors, to keep the required pressure on the cutting edge of the bit. A close-up (above) of the bit shows the clean hole cut and method of discharging the cuttings through clearance apertures in the head.

All station yard grading was done mechanically, with small bulldozer-equipped tractors being employed for the final levelling of the fill and distribution of topsoil after the roughing-in had been done with heavy crawler-type bulldozers and dragline units.

Where angles in the line, as at crossings, required an abrupt shift in ditch direction, bell-hole welding was utilized to join the adjacent sections. Digging these bell holes was a task assigned a back hoe by several of the contractors, and much time saved over pick-and-shovel work. At left, a back hoe, supported on mats spanning the trencher ditch, excavates a bell-hole in heavy clay.

on the T-G-T

24 INCH GAS LINE

from Texas to West Virginia

INTERNATIONAL

TracTracTors

One of 32 TD-18 Bullgraders and Side Booms operating on the T-G-T line within 100 miles of Houston. At home, as well as abroad, International is building a reputation for dependability, and low cost of operation.

Huge parts stocks carried by us in Houston and Dallas materially contributed to completion of this line in advance of schedule.

In addition, International maintains a tremendous Regional Stock in Dallas, supplementing our own large stocks. This combination assures prompt parts service, *SAVES YOU TIME, MAKES YOU MONEY.*

BROWNING-FERRIS MACHINERY CO.

The Largest Contractor's Equipment Company in the South

HOUSTON **DALLAS**

Bulk of the pipe, rather than its tonnage, decided the amount which could be handled by the stringing trucks, most contractors choosing to load equipment for the highway haul and then rely on tractors and winch lines to get the load up the steep hills and through the deep mud which in places made the line difficult of access. Above, a tow tractor ties to a truck in preparation for surmounting a 45-degree slope in East Texas hills. So steep were some of the slopes that on the down grade the tractor was used for snubbing the trailer.

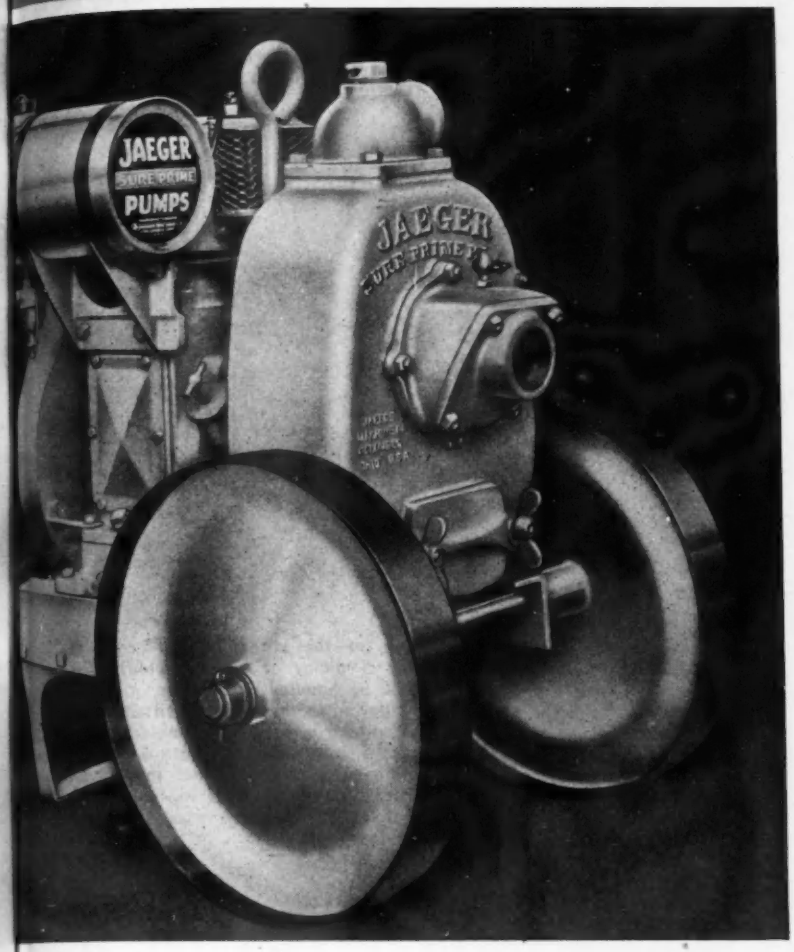
☆

Mud vied with foot-deep dust to delay operations on the line. At left, winches, tractors and all-out truck power are required to string the pipe through hilly clay country which was reached by the weatherman before the pipeline gangs arrived. Frequently the tractors were anchored to trees to provide maximum power without sudden shifts due to poor holding ground, and snatch-block lines were common.

on the T-G-T

24 INCH GAS LINE

from Texas to West Virginia



JAEGER *Sure-prime* PUMPS

Contractors who watch their costs know there's a *big* difference between a Jaeger "Sure-Prime" and an ordinary pump of the same size and rating. Jaeger Pumps are built to *exceed* their promises—deliver their rated capacity under tougher conditions, prime unfailingly and up to 5 times faster, assure you of thousands of *extra* hours of dependable cost-cutting service during the post-war building years ahead. INDIVIDUALLY TESTED AND CERTIFIED for vacuum, capacity and pressure. Sizes 1½" to 10"; gasoline, electric or diesel power.

JAEGER MIXERS

gest selling mixers in the U. S. and all over the world, eger mixers have every feature for fast, easy operation, g trouble-free life. Husky dependable power units w through automotive type oil-bath transmission—t mine 90%; operate more smoothly and years longer. um roll on machined tracks and chilled, ground ball ring rollers—use less power, run quieter, wear longer. eger Automatic Skip-Shaker empties skip in 5 to 7 conds (shakes at the throat, no thrust at the drum) fastest discharge of any mixer, means more batches r hour, more profit for you. . . . See Jaeger Mixers fore you buy.

BROWNING-FERRIS MACHINERY CO.

The Largest Contractor's Equipment Company in the South

HOUSTON DALLAS

This steep ridge (left) would be bypassed by anything but a pipeline right-of-way. A truckload of pipe, truck motor going all out, is also towed by a tractor and assisted by the winch line from a second crawler unit, spotted near the crest of the rise, and pulling across a tread to give firm anchorage. On some of the hogback ridges in Tennessee and Kentucky the line from the anchored unit was shifted from truck bumper to trailer axle as the load reached the crest, and the drum used to control descent of the load to the next valley.

☆

Some of the stringing was across the flat Coastal plains of Texas (below) where pipe could be handled at the rate of several miles per day when the rains permitted. Here, where no bending is required, stringing was made in parallel rows with alternate joints offset to permit quick rolling of each joint as men with 18-inch files touched up the beveled face just before the joint was aligned for welding.

on the T-G-T

24 INCH GAS LINE

from Texas to West Virginia

BUCYRUS-ERIE BULLGRADER

BUCYRUS ERIE TRACTOR EQUIPMENT

Ability to angle blade horizontally and/or tilt vertically, positive down pressure, and unusual balance, make the Bullgrader a versatile pipe-line tool. Available in sizes to fit TD-6, TD-9, TD-14, and TD-18 International Trac-TracTors.

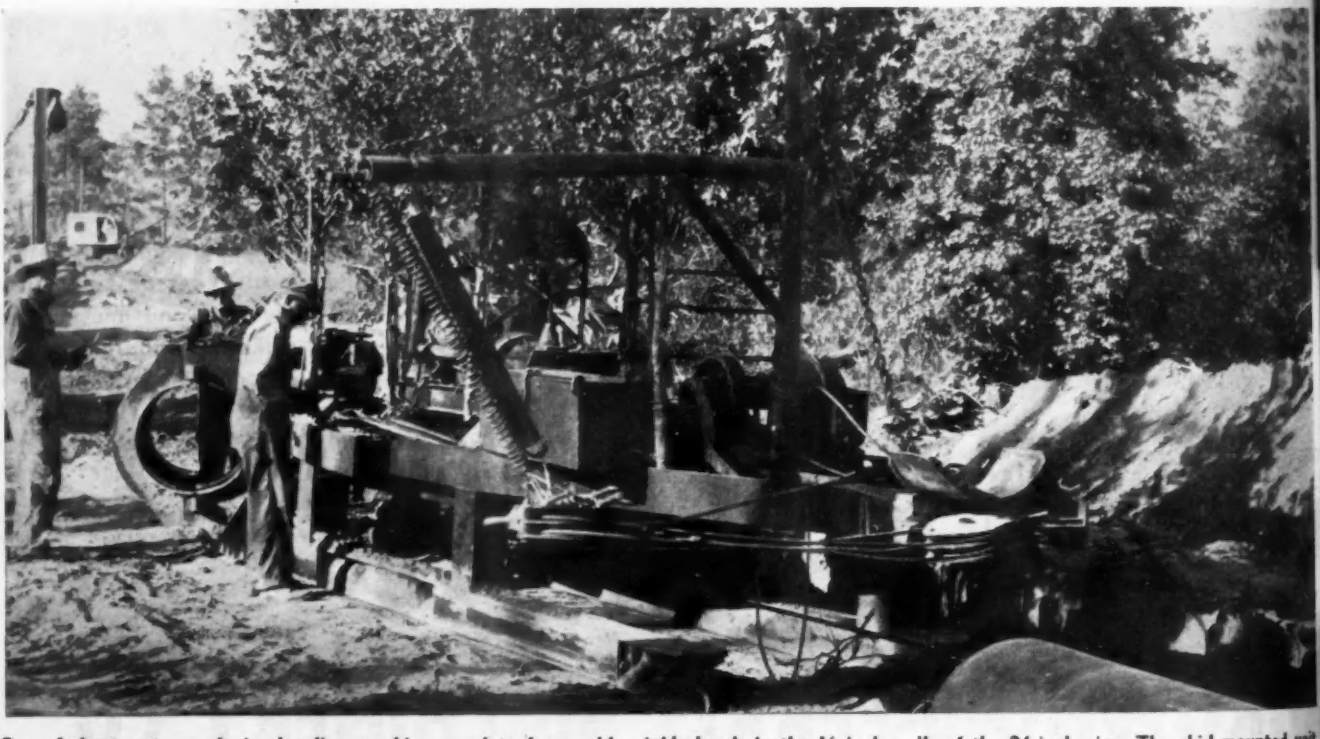
Bucyrus-Erie's complete line of tractor equipment is sold everywhere by International Industrial Power Dealers.

BROWNING-FERRIS MACHINERY CO.

The Largest Contractor's Equipment Company in the South

HOUSTON DALLAS

Cold bending was used throughout the line for all save such abrupt changes in direction that required prefabricated sections. The technique worked for handling the thin-walled pipe was such that no cross-sectional reduction was sustained, and the full diameter of the line retained. Here two mating bends have been put into the line to carry it into and out of a shallow depression crossing the right-of-way. The curved sections are nested to maintain clearance for passing traffic, but will align when bell-hole welded.



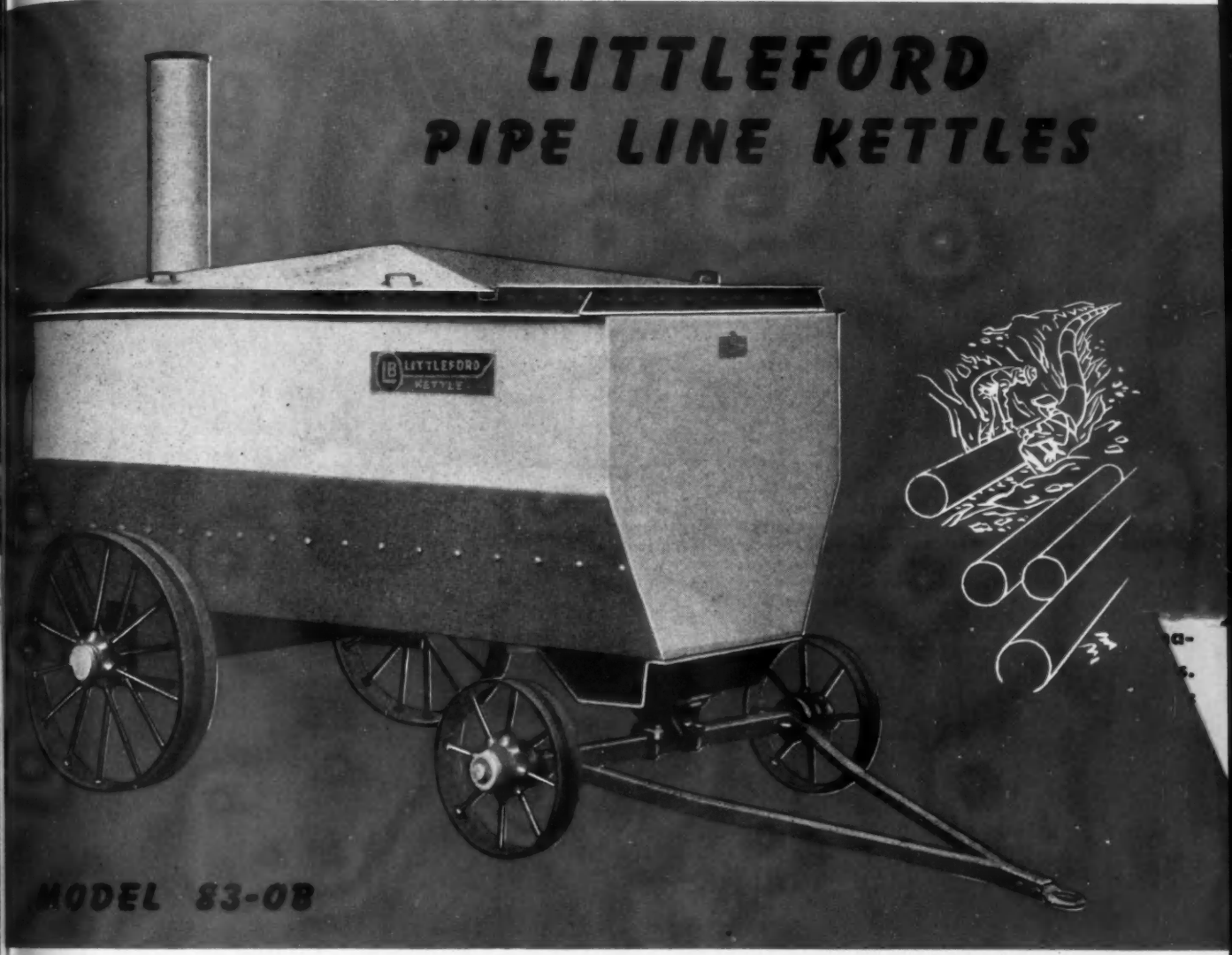
One of the two types of pipe-bending machines used to form cold wrinkle bends in the ½-inch walls of the 24-inch pipe. The skid-mounted unit is separately powered, exerting pull on the pipe through a four-line tackle deriving its pull from a winch geared through series-connected transmissions to give required tension on line. The arm at the back spring-suports the block, reducing fatigue for crews.

DUE TO WAR PRODUCTION OUR KETTLES WERE NOT ON THE

24 INCH GAS LINE

BUT NOW THEY'RE READY TO GO TO WORK AGAIN

LITTLEFORD PIPE LINE KETTLES



The features of the Littleford Pipe Line Kettle are the same as the famous Littleford Asphalt Kettle; that is, the patented "Double Heat Circulating System" and the "Screened Reservoir." These two features speed up the heating and make it possible to have a continuous flow of materials at all times, even when cold materials are added. Littleford Pipe Line Kettles are built sturdy, compact, easy to trail. These Kettles are heated with Littleford Vaporizing Torch Type Burners.

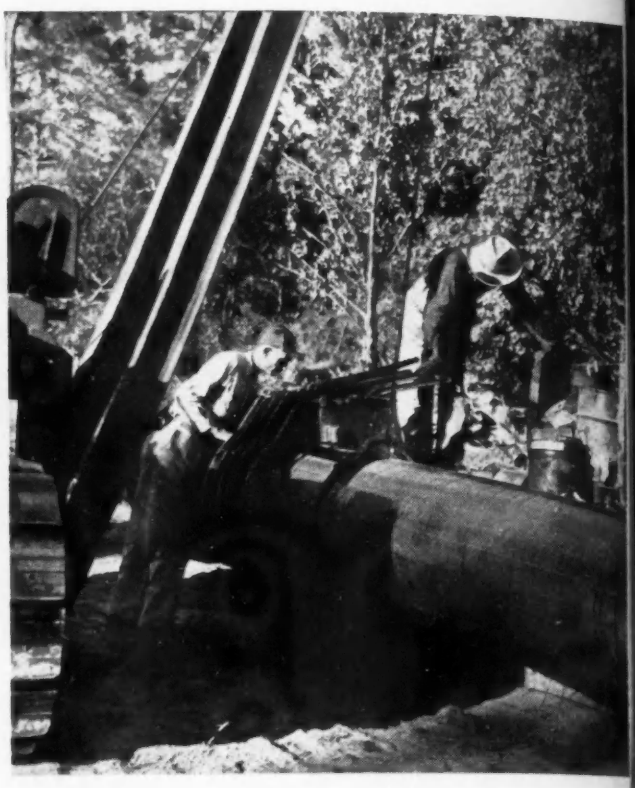
Littleford Can now supply your needs for your next job. For information and prices, write or call

BROWNING-FERRIS MACHINERY CO.

The Largest Contractor's Equipment Company in the South

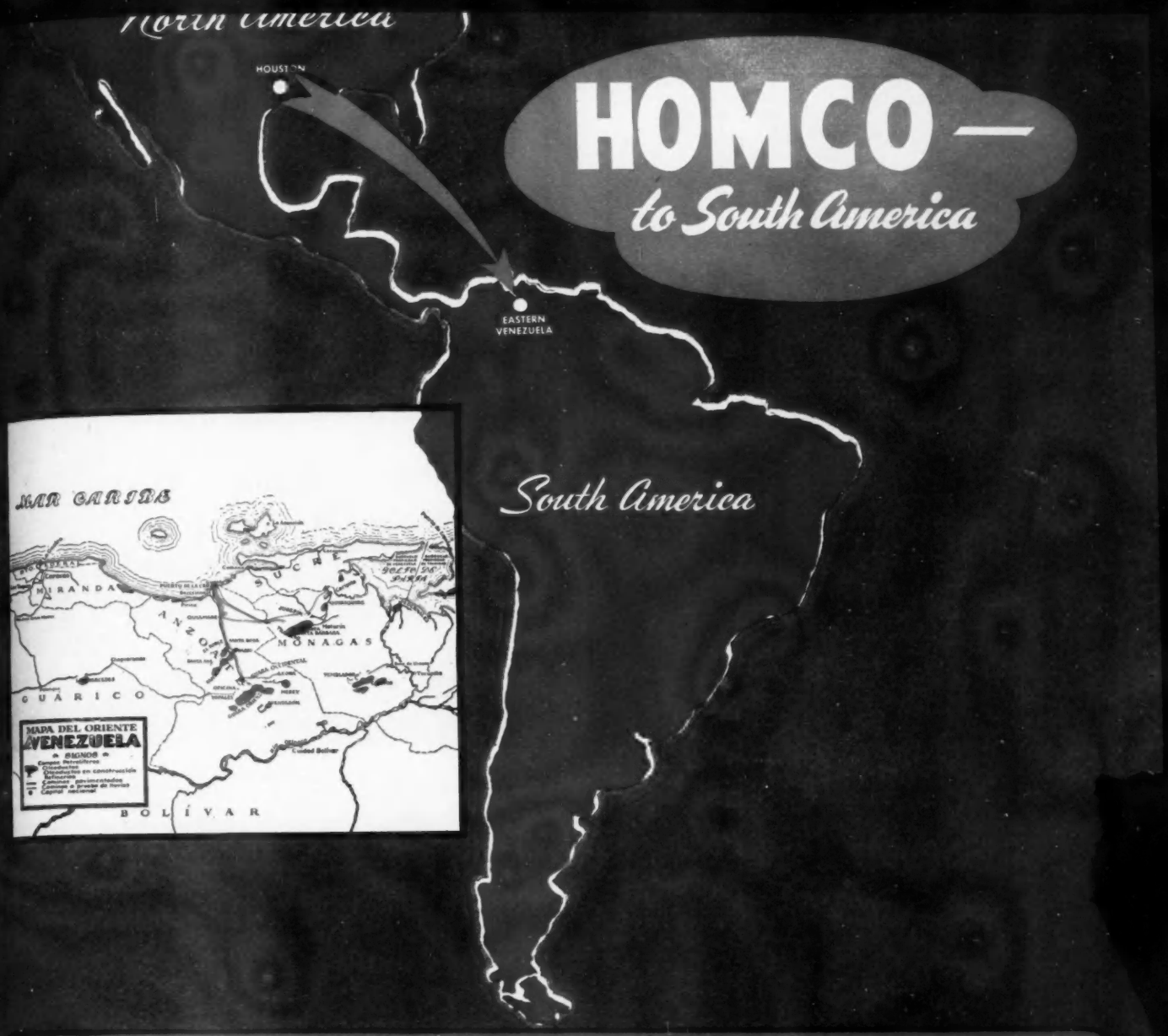
HOUSTON DALLAS

The joint is swung into position with the machine by a side-boom tractor, being previously marked at the proper intervals for spotting within the clamping head so no wrinkle will come within the scope of the jaws as the next wrinkle is being formed. The only precaution taken in spotting pipe is to see that the weld does not come within the area covered by the wrinkles as they are being formed.



When the joint has been slipped through the opened jaws of the clamp until the first mark is properly aligned, the separate clamping jaws are closed, gripping the line for some 12 inches and providing firm anchorage against the pull. The clamping member nearest the front is outside the wrinkle as formed, serving to maintain roundness of pipe and limit the area of deformation to the actual wrinkle.

The pipe spotted and all the clamping units closed, the loop attached to the pulling tackle is adjusted to give a straight pull, and power is applied. The bending foreman checks the arc through which the end of the pipe is pulled, checking the pull and holding tension until the pipe wall has set before releasing it for the shift through the jaws for the next wrinkle. The supporting yoke at the nearer end of the machine is for supporting the projecting end of the pipe, and to afford the desired rigidity to the portion clamped within the device which actually forms the wrinkle. The loop is made to enclose that section of the pipe under stress, and left open on the free side to facilitate entry and withdrawal of joint after bending.



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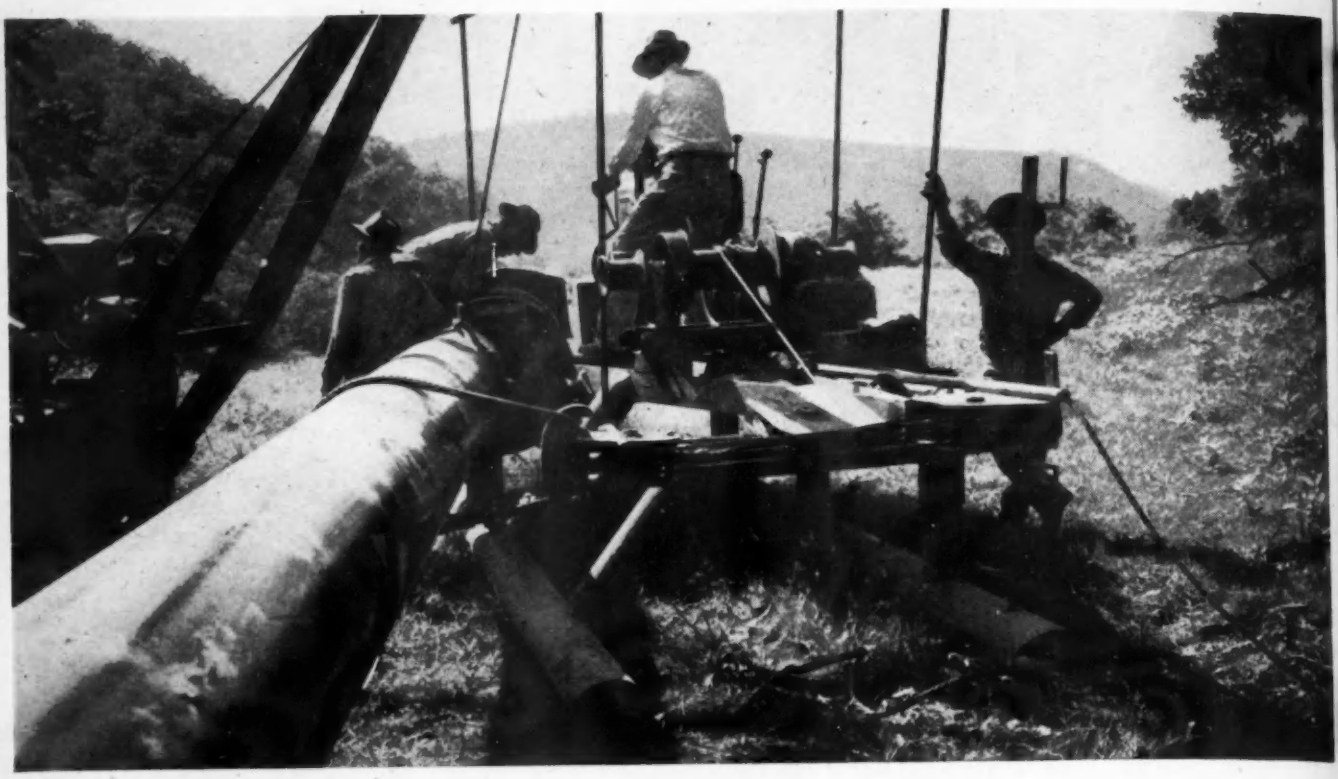

This type of pipe bending machine (above) utilizes an expanding mandrel to insure retention of pipe inner diameter while forming wrinkle bends, the end of the pipe being held in an adjustable yoke, while the wrinkles themselves are formed in an open yoke which little more than supports the inside half of the pipe as it is bent. The special block on the pulling line facilitates quick handling of the sling.

As evenly spaced as ripples on a placid pool, these two sets of wrinkle bends (left) carry the line down a 20-degree slope, across the flat and up the farther side, all within little more than the length of a single joint of pipe. The lack of distortion in the pipe except in the area of the wrinkle itself is attested by the uniformity of light reflection from the primed surface of the straight pipe.

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Houston, Texas

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"Cardwell" sidebooms combine speed and maneuverability with lifting power and ruggedness. "Cardwell" backfillers will fill twice the amount of ditch per day as the ordinary backfillers. Their working advantages mean money to any contractor.

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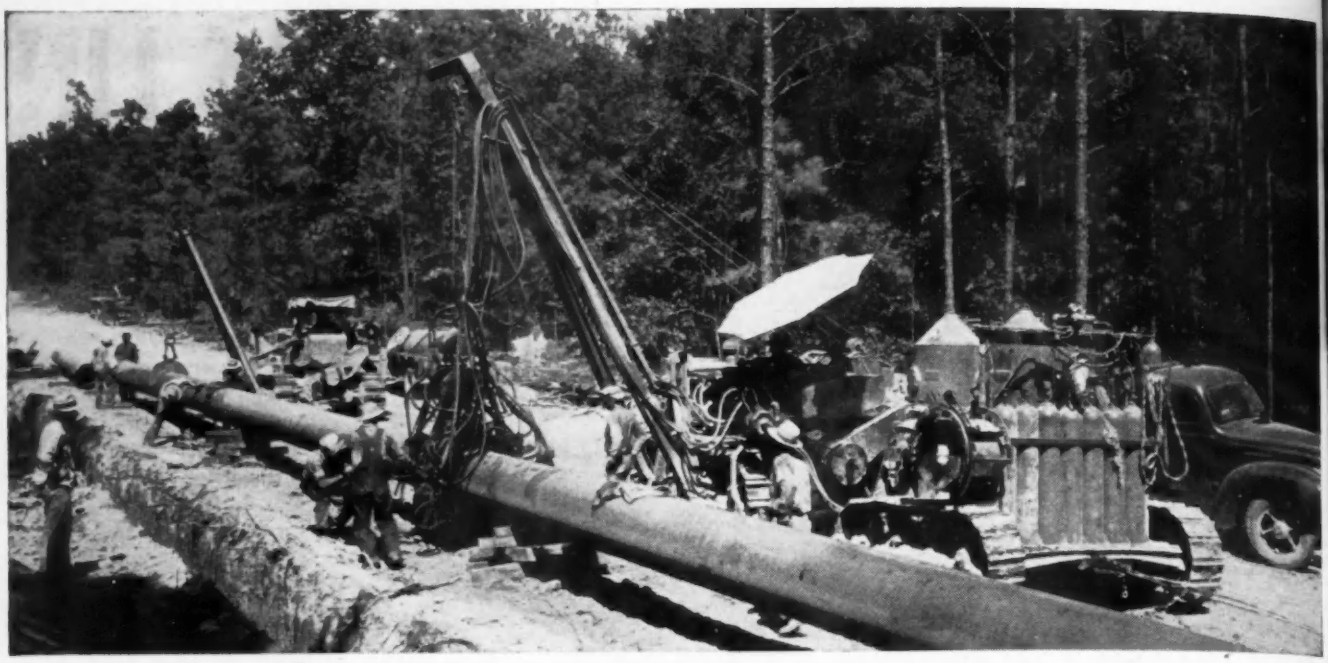
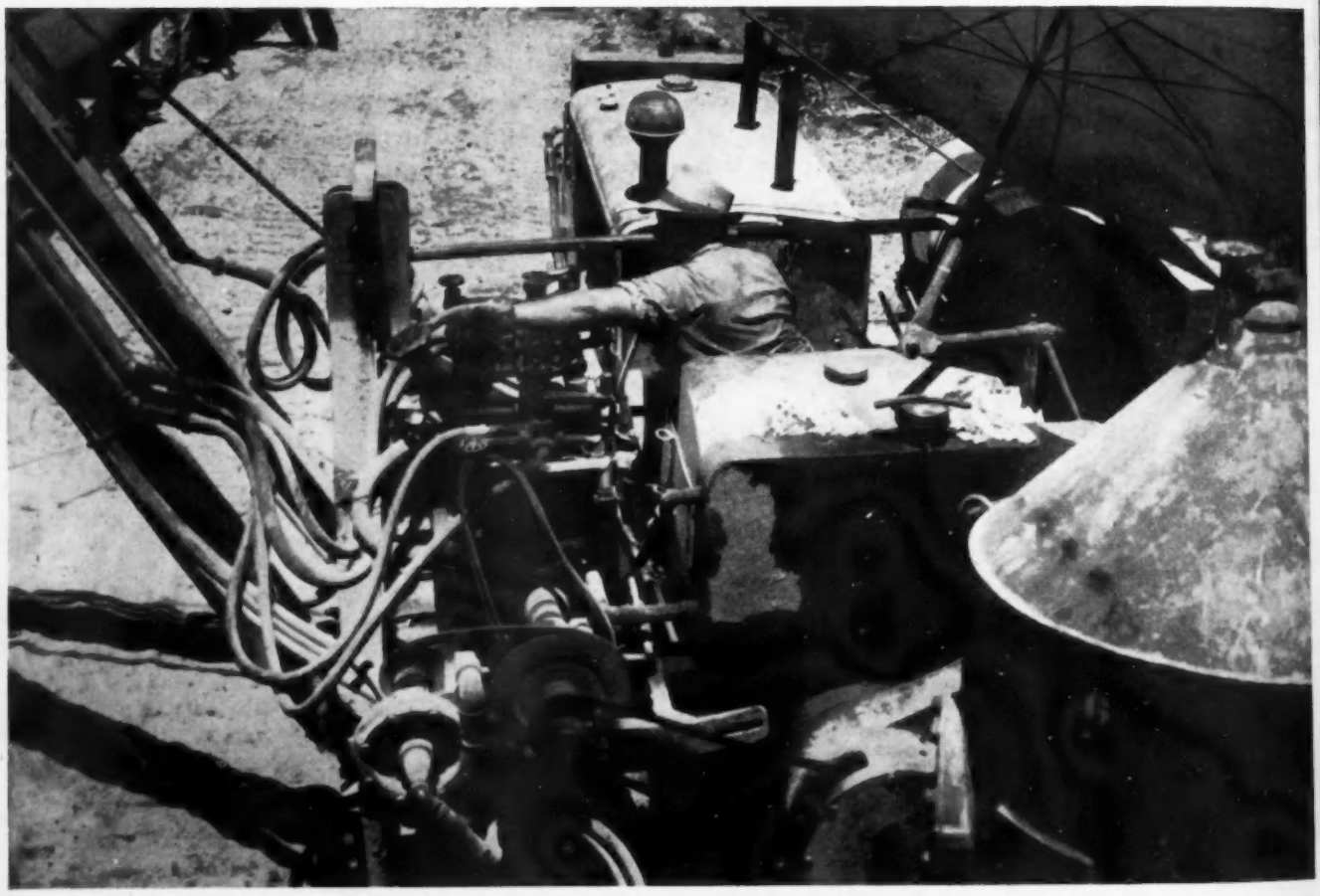
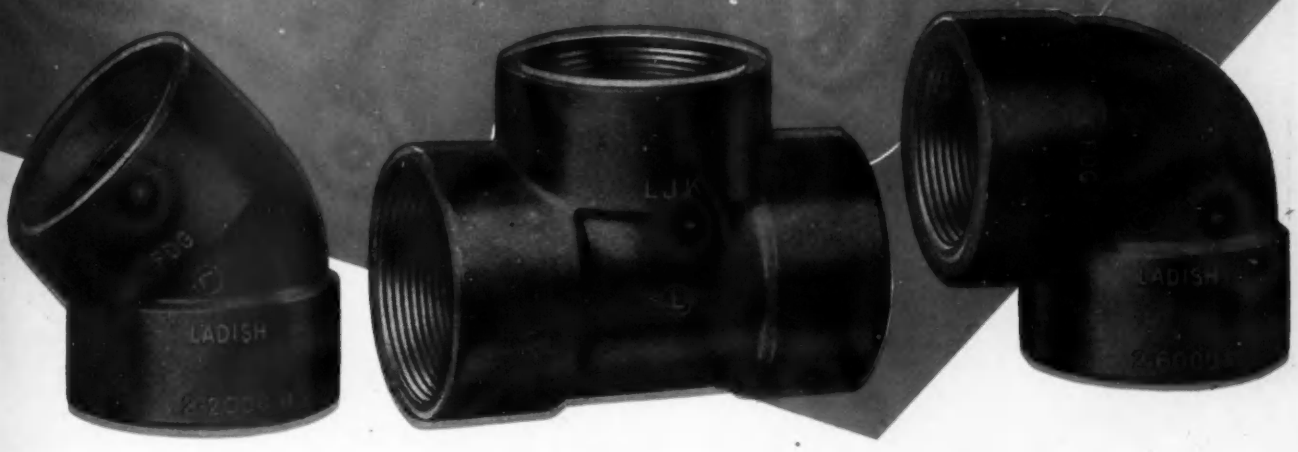


Stovepiping by the pressure-weld system, in which the metal of abutting joints of pipe is heated by oxy-acetylene flames and welded autogeneously, was used on the lower end of the line, extending over the first two spreads. The pressure-welding setup, with a grouping of hoses and equipment resembling a Rube Goldberg design, performs the alignment and welding operation with a set of clamping jaws which first align the pipe ends under hydraulic pressure and then, when welding temperature has been reached, move the free joint in against the completed line, holding it there under regulated pressure until the weld is formed. One tractor to align the pipe and the second to handle and power the welding head, constitute the moving equipment on a pressure-weld spread.



To the usual tractor drive and boom controls the pressure-welding system adds a bank of levers and valves which must regulate the flow of hydraulic pressure to the clamping and closing rams of the head, must provide for the flow of cooling water to the cored castings of the unit to remove excess heat, and must be so adjusted that from the driver's seat the entire unit can be instantly shifted.

Insure Better Performance



Specify Ladish *Controlled Quality* Forged Steel Pipe Fittings

Ladish forged steel fittings, carbon and alloy, are produced under exacting metallurgical control. Every Ladish fitting bears the symbol of Controlled Quality—the Ladish Heat Code.

Forged Steel Screwed Fittings

Full depth thread, accurately cut, results in pressure-tight joints. Pipe enters easily. Uniform thickness. Sizes clearly marked . . . ⅛" through 4".

Socket Welding Fittings

Speed up installation because deep sockets save time formerly required to cut pipe to exact length. Socket supports pipe and allows self-alignment. No machining of pipe necessary for fit. ASSURED WELDABILITY. Sizes clearly marked . . . ⅛" through 4".

TO MARK PROGRESS

ARMY E NAVY

FITTINGS DIVISION

LADISH DROP FORGE CO.

CUDAHY • WISCONSIN

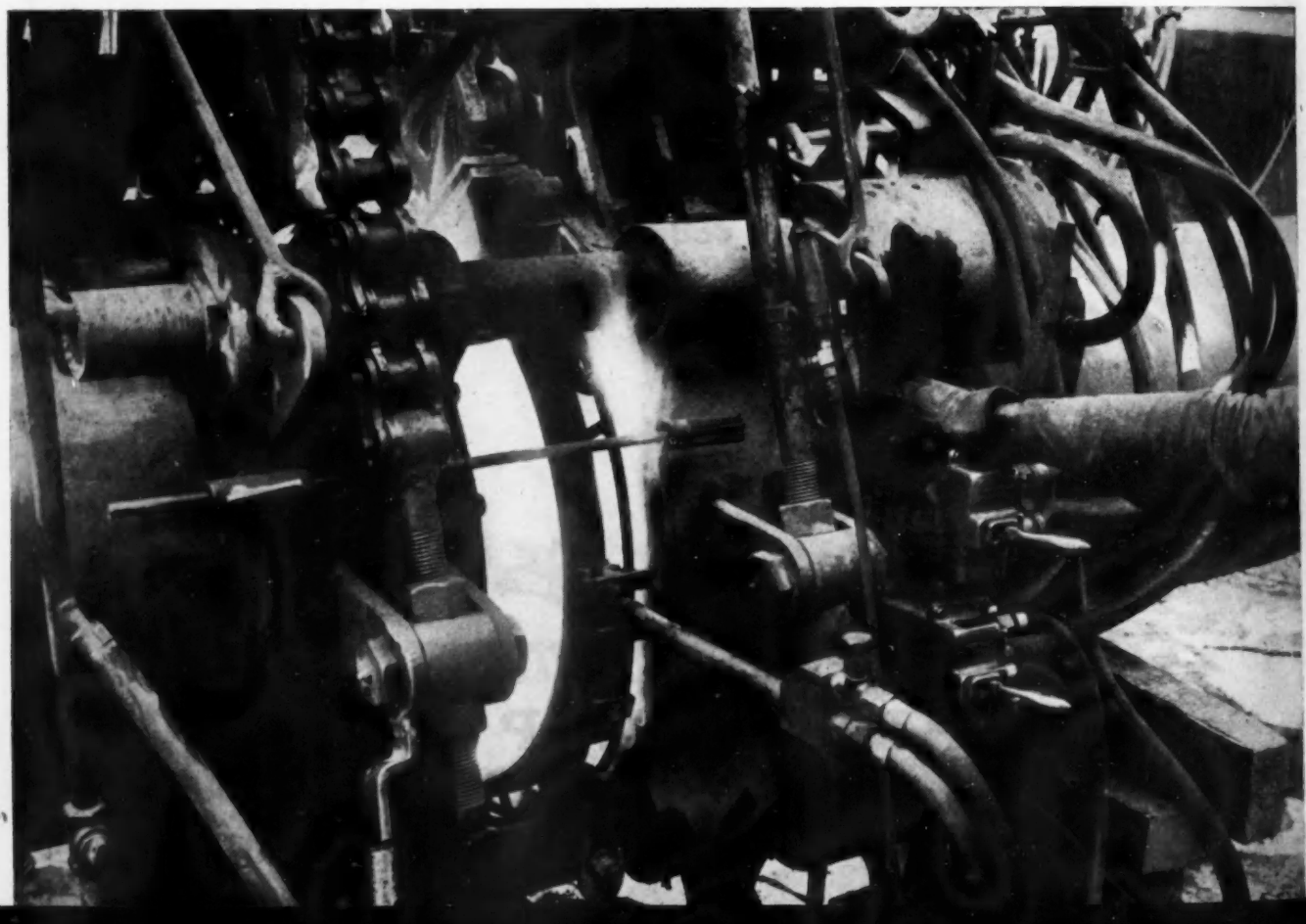
MILWAUKEE SUBURB

New York Office: 60 E. 42nd Street, New York City

Houston, Texas Office: 1005 Sterling Building

The welding head, with all the 365 heating jets ignited while the jaws are in the open position to show the flame arrangement and uniform distribution around circumference of weld, is shown above ready to be placed around line and abutting joint of the ¼-inch walled pipe. The head is initially positioned on the forked rest at the pivot, and adjusted to equalize pressure around the pipe wall.

Close-up of welding head (below) showing the chain-and-toggle device through which adjacent pipe ends are leveld, the hand controls for applying welding pressure and, centered over the welding flame, the ring which carries the individual burner tips. This unit is arranged to permit oscillation across the welding zone, so that the heat may be evenly distributed and the entire area brought to desired temperature before the rams are closed and the heated metal surfaces brought together under pressure. Entire weld requires less than a minute.



One weld just completed, the head is opened, raised and moved down the line to where the next joint has already been positioned, being leveled by means of light pipe supports with sloping tops. These supports, placed under pipe from opposite sides, form a V-shaped cradle which prevents shifting and cuts the amount of timber cribbing to that actually required for support prior to cleaning spread.

One of the requirements of the pressure-weld system is a clean pipe end. Beveled only slightly, the face of the pipe end is given a polishing operation with a small power-driven grinder, pivoted on support slipping within the pipe, and rotating to insure cleaning of rust which may have formed on bevel since fabrication. Severe distortion or nicks are removed before cleaning welding face.

The finished weld. The extent of the heated zone is shown by the shading of the clamp marks, where the heat-softened metal has been forcd by hydraulic power between the serrations of the gripping jaws. The weld forms a ridge on the outside of the pipe, with a similar though smaller ring of raised-fused-metal on the inside. This increase of wall at the weld makes the junction the strongest portion of the line. Tests proved that a joint, unsupported except by the weld, carried the curve over to the solidly supported section without deformation. The inside of the weld likewise shows a small ridge or welt completely around the pipe, but offering only negligible obstruction to the passage of scraper or gas flow.

Pressure

The Pressure Weld Company is now in a position to make available to pipe line companies and pipe line contractors, Pressure Weld Clamps and trained operators for the speedier and more economical welding of all sizes of pipe lines from 2" to 24", regardless of location, length or type of gas or fluid to be transported. An opportunity to figure with you will be appreciated. Plan NOW to have your future pipe lines Pressure Welded.

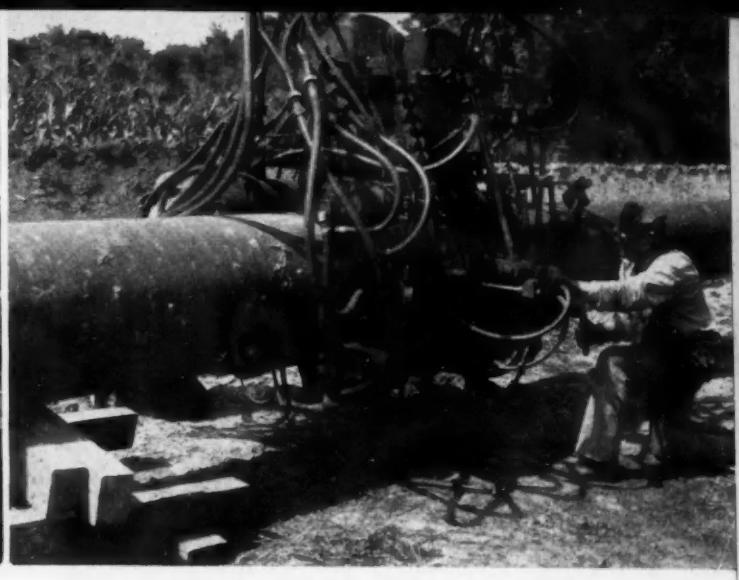
Pressure Welded pipe line jobs have now been completed for the following firms:

Border Pipe Line Co.
Cia. Carbonifera de Sabinas
El Paso Natural Gas Co.
Magnolia Pipe Line Co.
Phillips Petroleum Co.
Southern Pacific Co.
Tennessee Gas and Transmission Co.
Texas Pipe Line Co.
Tucson Gas, Electric Light & Power Co.
U. S. Bureau of Mines

You are cordially invited to ask them about the quality of the welding done and the savings effected by the use of Pressure Welding.

PRESSURE

★ ★ ★ ★



Welding ★ ★ ★ ★

SAVES TIME, MEN AND MONEY ON THE 320 MILE TEXAS SECTION OF TENNESSEE'S NEW PIPE LINE

Pressure Weld Clamps and crews, working with the four spreads of the three contractors on the 320 mile Texas section of this gigantic new pipeline from Corpus Christi to West Virginia, established spectacular records for speed, economy, and high quality welds. The work was done in a considerably shorter time with far less equipment and some 100 fewer men were required than if this section had been welded by older methods. The records established on the Tennessee and previous jobs have proven conclusively that Pressure Welding is the unrivalled modern way to weld pipe lines, whether they are large or small, short or long, high pressure or low, to carry natural gas, oil, water, other fluids or gases.

For information or literature descriptive of the Pressure Welding method, write, wire, or telephone

WELD COMPANY

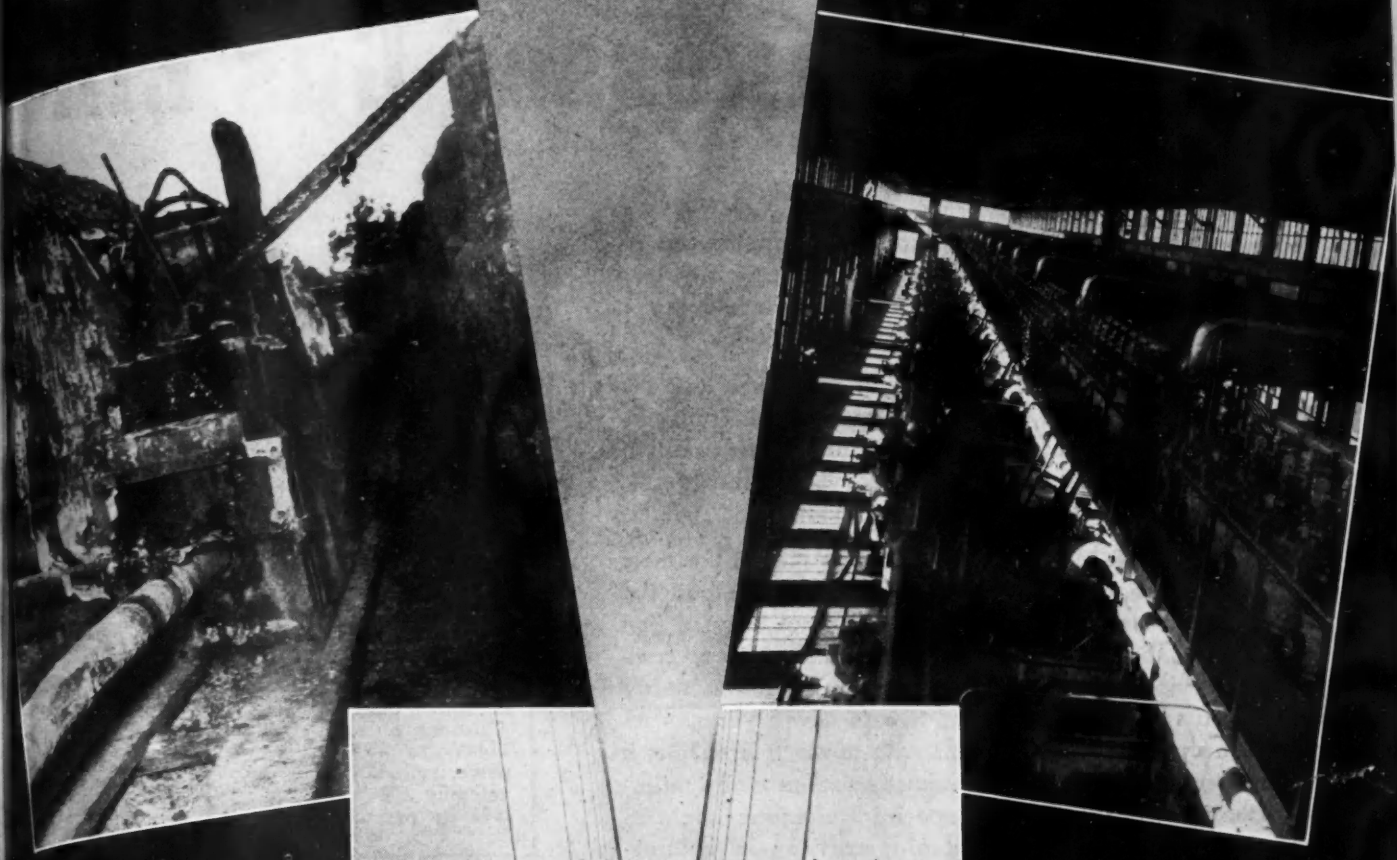
421 NIELS ESPERSON BUILDING
HOUSTON 2, TEXAS

Phone Charter 4-1839

Arc welding was used in both stovepiping and firing-line welding over the line from the end of the pressure-weld section to the final distribution point, with the tie-ins of fittings, block gates and similar units being by use of the arc. A typical welding spread in which the thin-walled pipe is being stovepiped to the main line shows the relative ease with which the gasline pipe could be manhandled, as against the much heavier pipe used on the "Big Inch" line. After welding, only minimum cribbing is left to support line.

Finishing off the bead by bell-hole welding of two sections of line to be pushed through a long railroad crossing bore after the two parts have been aligned on cribbing and roll-welded by two men at each junction. The combination ground connection and umbrella stand reduces the equipment to be shifted, and shortens pipe conductor length to minimum.

"Well done, T-G-T"



Republic Supply Company

GENERAL OFFICES: HOUSTON, TEXAS

31 G-MV Compressors

(PRODUCING 31,000 HORSEPOWER)

on the Tennessee Gas Line

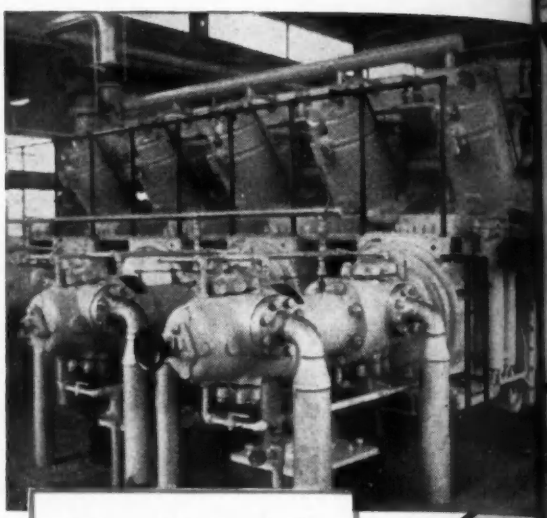
The G-MV's are in operation — pumping gas on the new Tennessee Line from Corpus Christi to Cornwall — 31 big 10-cylinder V-angle engines, each developing a conservative 1,000 horsepower.

These Cooper-Bessemers, representing well over half the compressor horsepower on the Tennessee Gas & Transmission Company project, are located on the northern portion of the line — at the Batesville, Miss., Lobelville, Tenn., Campbellsville, Ky., and Ashland, Ky., stations.

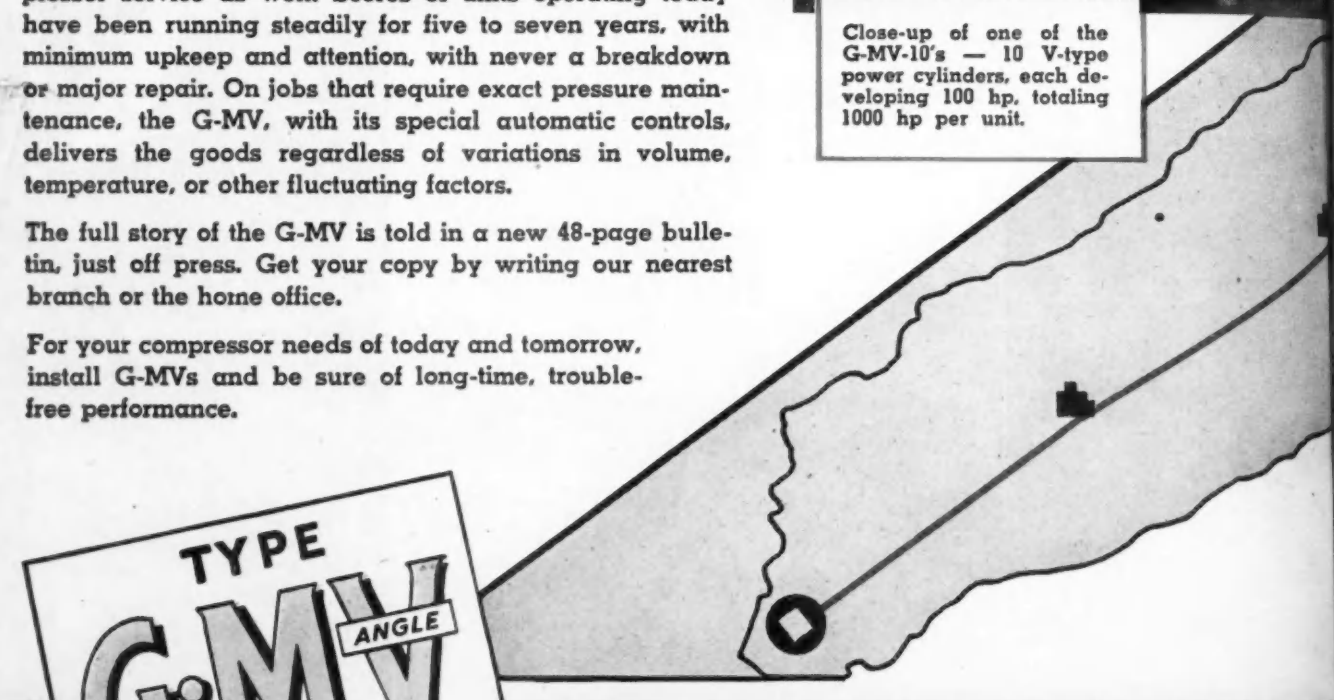
In selecting the G-MV, T. G. & T. officials picked the most efficient compressor to be had — one that has stood the test of continuous, tough performance — not only in gas transmission, but in all other phases and types of compressor service as well. Scores of units operating today have been running steadily for five to seven years, with minimum upkeep and attention, with never a breakdown or major repair. On jobs that require exact pressure maintenance, the G-MV, with its special automatic controls, delivers the goods regardless of variations in volume, temperature, or other fluctuating factors.

The full story of the G-MV is told in a new 48-page bulletin, just off press. Get your copy by writing our nearest branch or the home office.

For your compressor needs of today and tomorrow, install G-MVs and be sure of long-time, trouble-free performance.

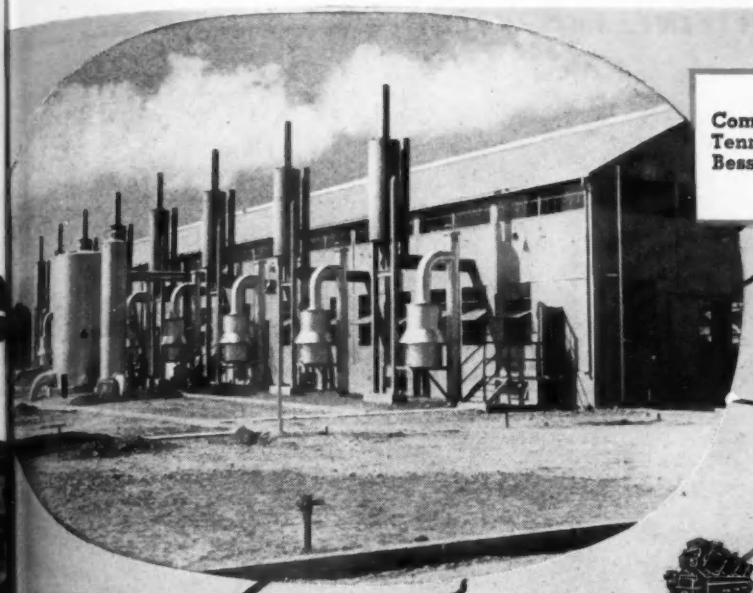


Close-up of one of the G-MV-10's — 10 V-type power cylinders, each developing 100 hp, totaling 1000 hp per unit.



TYPE G-MV ANGLE Compressors

New York Washington Bradford, Pa. Parkersburg, W. Va. San Francisco, Cal. Seattle, Wash.



Compressor station at Lobelville, Tennessee, housing eight Cooper-Bessemer Type G-MV Compressors.

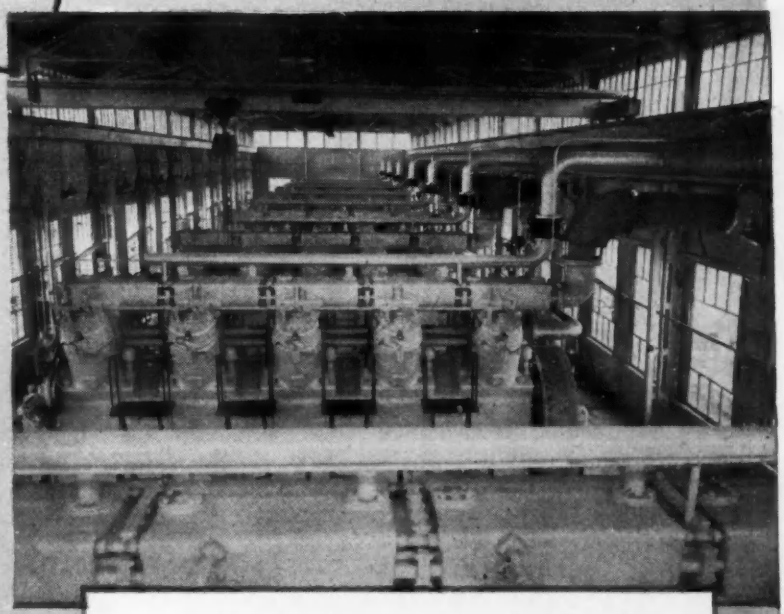
Ashland

Campbellsville

Lobelville

Batesville

Cooper - Bessemer G - MVs equip 4 of the compressor stations now installed. Seven more to be built later.



Interior of the compressor station at Lobelville, Tenn., showing the battery of eight big G-MV's, representing a total of 8000 horsepower.

by **Cooper-Bessemer**

MOUNT VERNON, OHIO and GROVE CITY, PENNA.

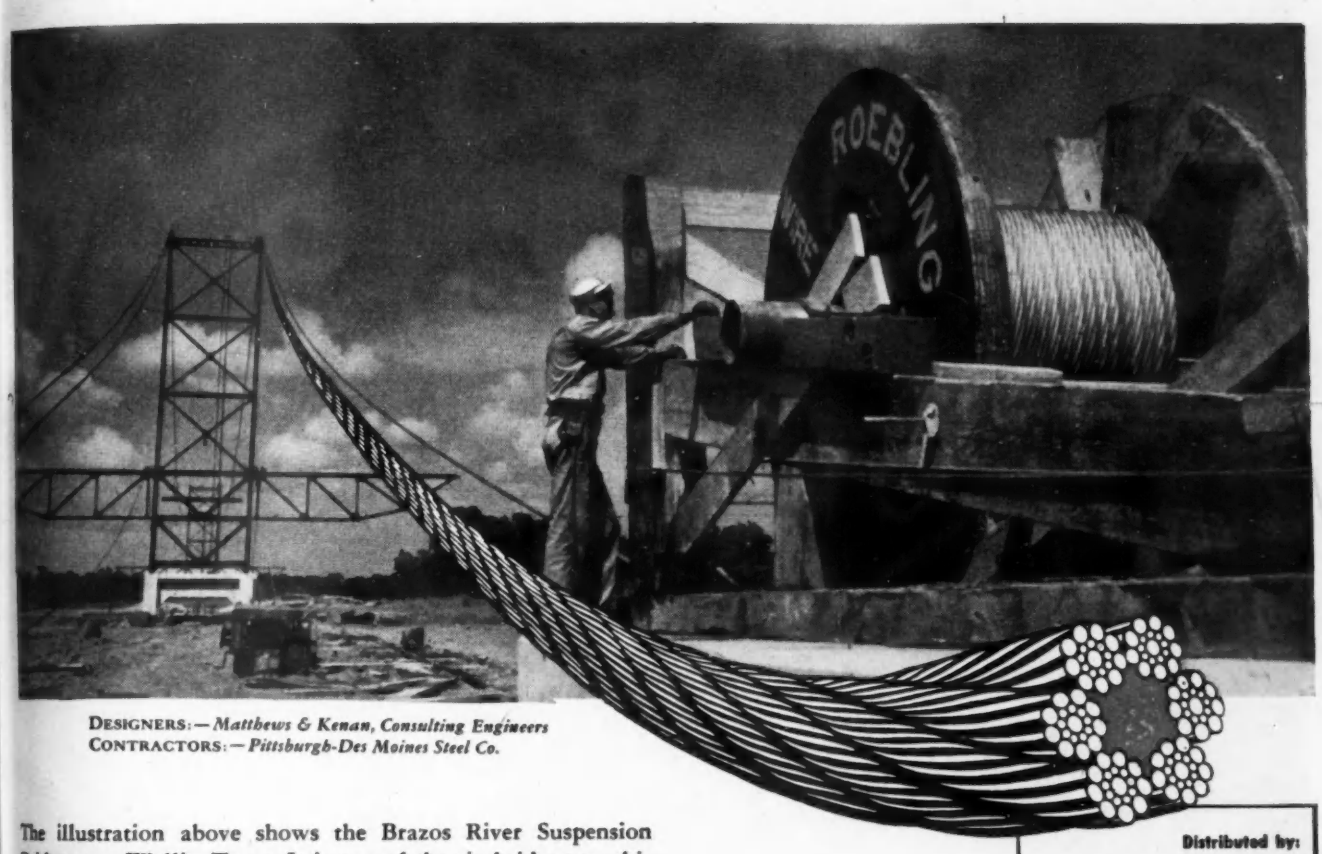
Houston, Dallas, Greggton, Pampa and Odessa, Texas Tulsa Shreveport St. Louis Los Angeles

Usual practice called for two tractors, one side-boom equipped for spotting pipe for the alignment clamps, the second serving to tow the skid on which were mounted generating equipment, conductor leads, spare equipment and a stock of welding rods. The outfit also included oxy-acetylene for use with the bevelling machine, used when a pipe end, damaged in transit, had to be removed in joining.

A welding unit chugs down the right-of-way to where the terrain requires the firing-line welding of a section for a highway crossing. The tractor drags the specially built welding skid, mounting two complete welding generator units, and behind that, a second and lighter skid, which serves as supply "wagon" for the crew, with drinking water, welding rods, spare pipe alignment clamps and the supply of oxygen and acetylene for the torch when a damaged end must be cut from a joint and the end rebevelled for welding.

From Texas to West Virginia... over six suspension bridges... stretches the Tennessee Gas and Transmission Company's 24-inch pipe line... 1260 miles of testimony to the high esteem held for Roebling Wire Rope by the Petroleum Industry. It's another reason why you can depend on...

ROEBLING "Blue Center" STEEL WIRE ROPE



DESIGNERS:—*Matthews & Kenan, Consulting Engineers*
CONTRACTORS:—*Pittsburgh-Des Moines Steel Co.*

The illustration above shows the Brazos River Suspension Bridge near Wallis, Texas. It is one of the six bridges on this new line which vary in suspended span from 560 feet to 1920 feet. All cables and suspenders and their end fittings were supplied by Roebling.

And what can *you* expect from Roebling?

Rope that has known capacity to deliver service. Engineering, in our plant and at your job, to put the rope to work right. Maintenance practices that protect its long life.

Your postwar profits and postwar jobs will depend in part on operating rope-rigged equipment at lowest cost. You can leave that part to Roebling.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY • Branches and Warehouses in Principal Cities

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ROEBLING

PACEMAKER IN WIRE PRODUCTS

WIRE ROPE AND STRAND • FITTINGS • SLINGS • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • COLD ROLLED STRIP AERIAL WIRE ROPE SYSTEMS • ROUND AND SHAPED WIRE • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • WIRE CLOTH AND NETTING SUSPENSION BRIDGES AND CABLES • ELECTRICAL WIRES AND CABLES

The entire line was given what is now considered standard practice for buried lines: a primer coat of quick-drying enamel and a hot coat of enamel, followed by a wrapping of felt to give a bonded protector which is at once insulant and line cushion. The cleaning machine, traveling under its own power except on steep inclines, rides a loop of line cleared from the cribbing by the side-boom tractor following it. To minimize the dust coating which settled on everything during work in dry months, the priming was followed closely by final coat and wrap, this being feasible through the quick-drying characteristics of the primer coat.

Over rolling country, the wrapping machine rides the grades on the pipe cleared by the two-side-boom tractors. Where the grade was too stiff, the machine was aided by a winch line from the forward tractor, or held back by men dragging on tail ropes, to insure uniform coating of both enamel and wrapping felt. In this view, the reflection from the prime-coated line testifies to thorough coating.

Throughout the job, full use was made of motorized equipment. Here the tractor which carries the dolly on which the elevated loop of pipe rides for passage of the wrapping machine also drags the dope kettle. To prevent delay as enamel supply from one kettle was used, a second is spotted ahead by a tow tractor, and continuous operation of the wrapping during favorable weather assured.

The many wrinkle bends required in rolling country offered no obstacle to the priming machine, which cleaned and coated the bends satisfactorily, but the close adjustment required on the wrapping unit made it necessary to leave "skips" when passing over the elevations in pipe surface, and a gang of hand finishers was brought along to apply extra dope and hand or "cigarette" wrap the bends.

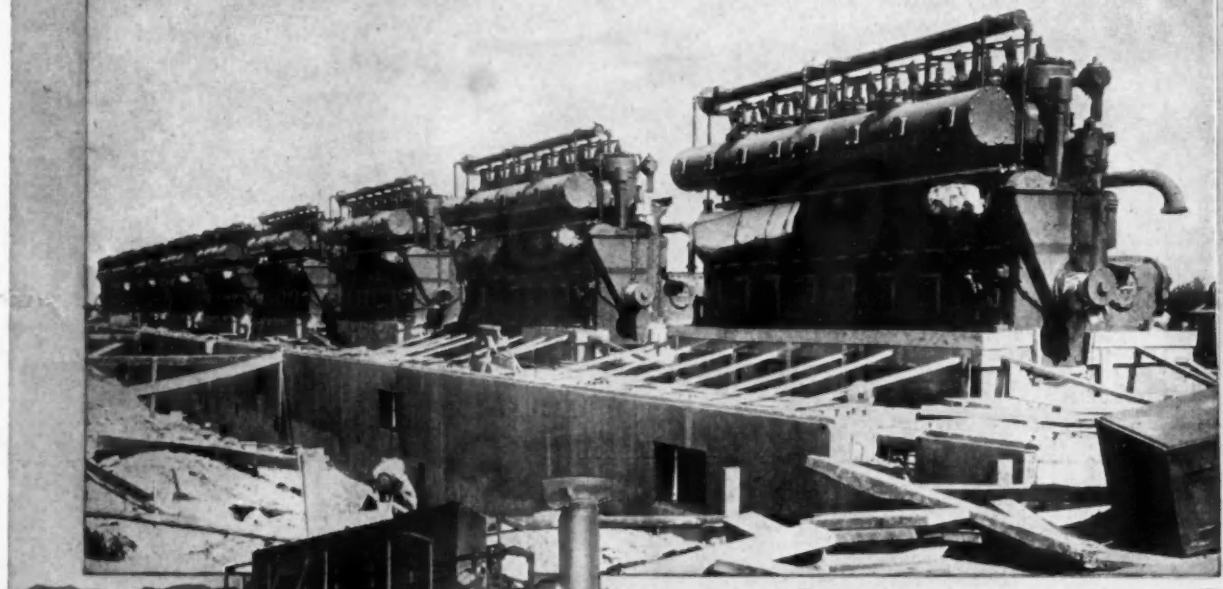
ON THE BIGGEST GAS

Tennessee Gas and Transmission Company Selects Worthington Engine-

WORTHINGTON Angle Engine Compressors—27 of them, totaling 27,000 hp.—are pumping war-essential gas from Texas to Mississippi, through approximately 50% of the big pipe that stretches across the continent to West Virginia.

But Tennessee Gas and Transmission Company, in pushing forward this biggest gas pipeline job in a decade, came to Worthington for more than compressors alone.

Engine generating units — pumps — other accessories — all Worthington —



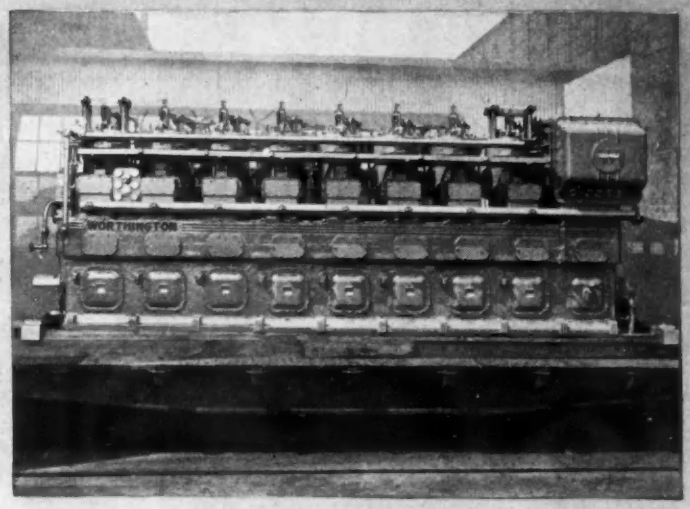
Nine of 27 of Worthington 1,000 hp. LTC-8 compressor units being installed in one of the main line pumping stations on Tennessee pipeline. Also shown is one of the nine 6-cylinder gas engine generator units, type CCG, supplied by Worthington, and providing 2250-KW. for station auxiliary power.

PIPELINE JOB SINCE '32

Compressors, Generating Units and Pumps for Main Line Pumping Stations

were supplied from a single source, engineered together as complete units for highest efficiency.

Another construction victory in Tennessee Gas and Transmission Company's win-the-war effort. Another example, too, of Worthington's pipeline "know-how" and broad range of products for gas and oil transmission now at work for Industry and the Nation. Write us for complete details. *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*



A Worthington 1,000 hp LTC Gas Engine Compressor ready for shipment.

5 Reasons Leading Companies Specify Worthington for Pipeline Units

1. **Heavy Construction**—ample masses of metal in correct structural relation, for strength, rigidity, maintained alignment, low maintenance, long life.
2. **Straight-Line Design**—maximum accessibility for simple, safe inspection and adjustment. Smooth power flow from equally spaced power impulses.
3. **Single Scavenging Air Pump**—easily accessible for maintenance, with simple piping for low-cost installation
4. **Cone-type Cylinder Head**—bolt-loading on cold upper surface, no risk of cracking when tightened, no bending under heat stress, cuts engine repair cost.
5. **Cast-In Lube Oil Ducts**—all lube oil in cast-in passages ends risk of pipe breakage, with no joints or pipes to break or loosen.

Unwatering of the trench, once the line has been laid on its cushion of mulch, was necessary lest the displacement of the light pipe act to bring it to the surface through the unconsolidated backfill. Here the main line, blanked off to prevent entrance of water and silt, is being cleared preparatory to dragging in the long string of roll-welded river crossings tie-in. Due to the caving nature of the soil when wet, the bell hole for the tie-in weld is not dug until the last moment, and the suction of the pump then moved in to save the welder anything more serious than wet feet. The end of the line in the foreground is supported on blocks until welded in place.

Through sandy soil or where extreme drouth robbed the earth of its natural stability, it was necessary to clean out the trench just before lowering the pipe in place. On some of the spreads the usual gang of shovelers, working over their heads to clear ditch, was replaced by a clam-shell unit, traveling under its own power immediately behind the wrapping crew, and completing the preparation of the ditch for the pipe. By skillful handling of the buckets, mulch was spread more evenly than the usual hand distributing.

TWO IMPORTANT MEMBERS of the Diamond D-X Line

SOLVENT-PROCESSED DETERGENT-TYPE OIL

D-X **Heavy Duty** Motor Oil provides greater oiliness and comparative freedom from compounds that might form sludge. Its detergent and highly dispersive action prevents and removes deposits of oil-oxidation products . . . keeps all engine parts clean . . . rings and valves free . . . and seals in power.

A Superior Lubricant for Truck, Bus and Other Engines in Heavy Duty Service

EXTENSIVELY FIELD-TESTED AND USED FOR ALL DIESELS

D-X **Diesel** Motor Oil meets the growing demand for dependable lubrication of Diesel equipment. The base lubricant is solvent-processed from selected paraffin base crudes. Provides high resistance to sludge formation, high detergency and dispersive action; protects bearings against corrosion.

For Safe and Economical Lubrication of All Makes and Types of Diesel Engines

Throughout the Central States, the trademarked products . . . D-X and D-X Ethyl Motor Fuels and Diamond 760 Motor Oil . . . have been the choice of tens of thousands of motorists who want quality petroleum products. Also, this famous line includes a complete assortment of Diamond D-X Lubricants and Greases and Specialty Products.

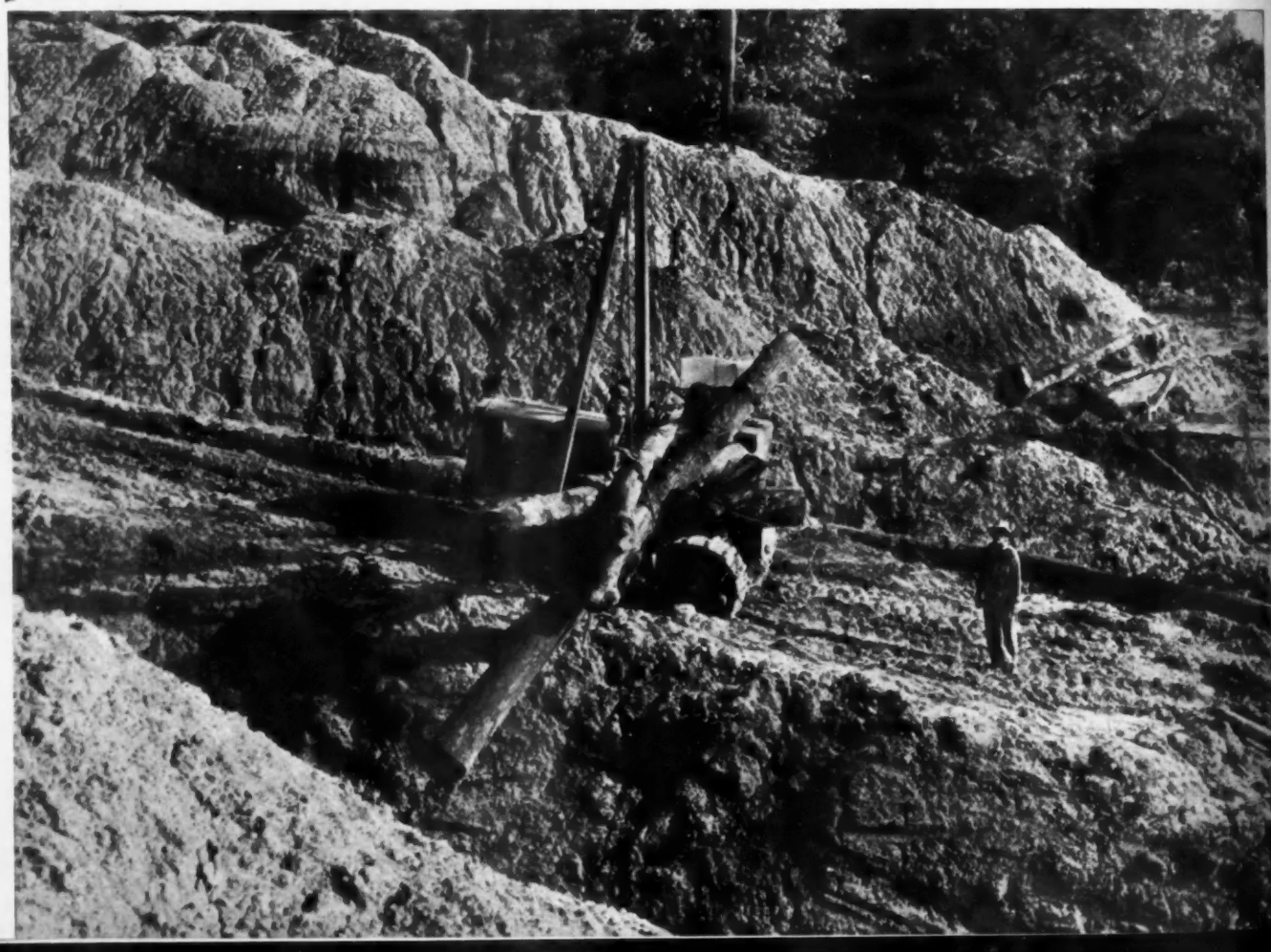
MID-CONTINENT PETROLEUM CORPORATION

Chicago Omaha TULSA, OKLAHOMA Terre Haute Waterloo

Three or more side-boom tractors were teamed together to pick up the string of extremely flexible pipe, swing it clear of the cribbing and lower it to the bottom of the 6-foot trench without so much as rubbing the protective coating against the earthen walls. The band formed by the farthest sling will be used to form the required clearance over the edge of the ditch as the other units lower their load to the loose earth cushion covering the bottom of the trench. Lowering the boom places the pipe in lowering position.

☆ ☆ ☆

Due to extreme flood conditions encountered on some of the river crossings, the problem of backfilling is intensified by the need for insuring against flood-water scouring before completion consolidation. Here, at the crossing of the Ouachita River, a side-boom tractor brings down a load of oversize logs, salvaged from the right-of-way clearing through an adjacent swamp. The logs are laid in the trench near the pipe, and woven into a gigantic mat which holds the wet backfill and prevents the entry of scouring eddy currents.



Distribution . . .

a Vital Link!

TWO highly important forms of distribution affect the oil and gas industries. One, distributing the products—such as the new Tennessee Gas and Transmission Line; the other, distribution of the necessary equipment to make possible the production and transportation of oil and gas.

The Continental Supply Company, leading distributors of prominent equipment lines, is a vital link serving the industries. Strategic location of its sales and distributing points permits Continental to serve the oil and gas producing and transporting interests to best advantage.

Youngstown Line Pipe • Mark Unions • Plug Valves • Welding Fittings
. . . are some of the materials supplied by Continental in the construction of the Tennessee Gas and Transmission Pipe Line.

THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS
EXPORT DIVISION
30 Rockefeller Plaza New York City, N. Y.
Representatives
MEXICO ARGENTINA ENGLAND TRINIDAD BRAZIL

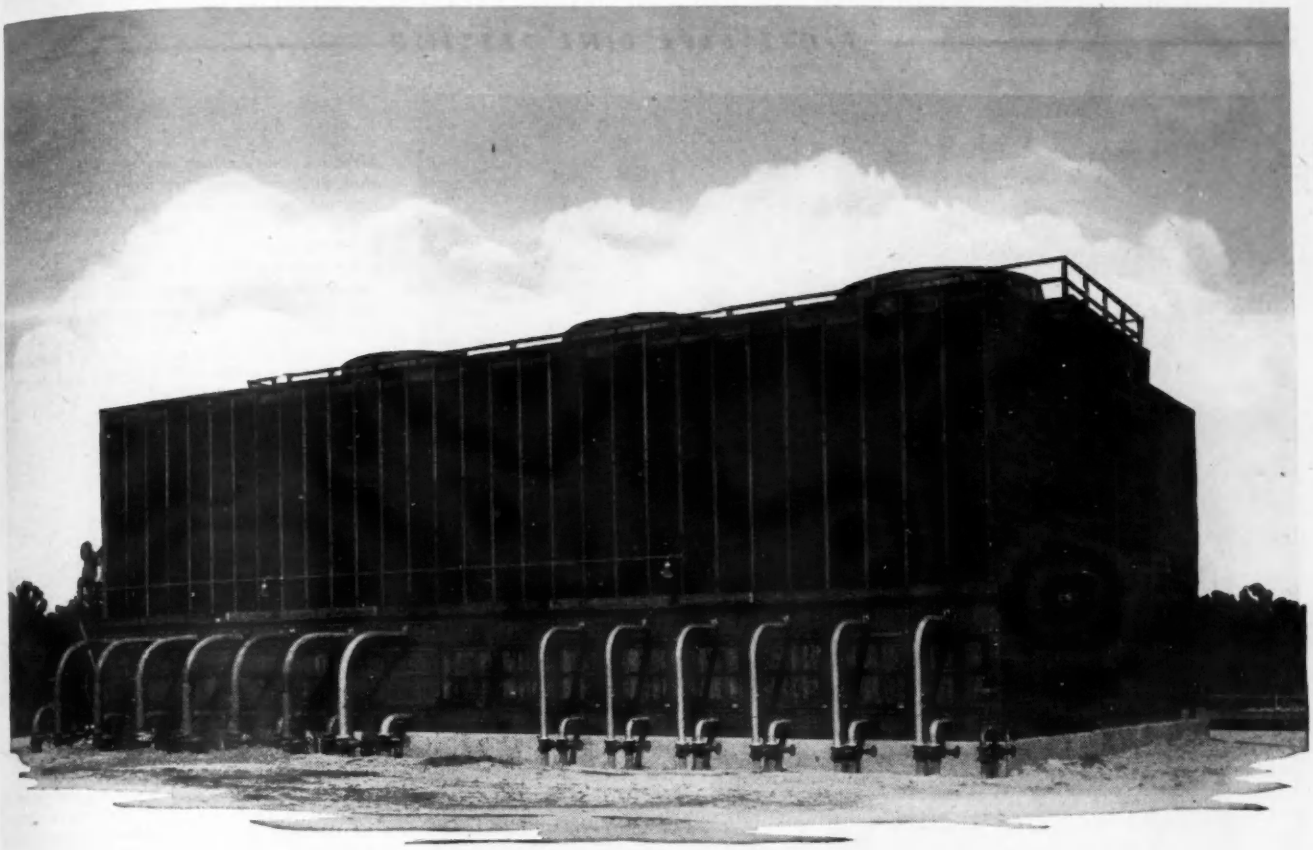
CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

All sections destined to be run through highway or railroad crossings were sealed and given a preliminary compressed air test before being placed in the ditch. A special head (above) consisting of a heavy steel disk welded to a short ring or nipple of 24-inch line pipe, was welded to close each section, this method calling for a simple circumferential weld and avoiding possible damage to the disk when the seal is removed by the torch after completion of the air test. When removing, the cut was always made in fresh pipe metal.

☆ ☆ ☆

Block gates (left) isolate the line into sections approximately ten miles in length, each block gate being flanked by risers and gates which permit the release of pressure on the section closed for repairs or checking. The line is supported on heavy concrete piers at each block gate, with the support stopped off at the median line so the line may shift longitudinally under expansion stresses without being cramped at the support. The relief gate riser is located directly above the supports to minimize vibration when being blown down.



STEARNS-ROGER, engineers and contractors for TENNESSEE GAS & TRANSMISSION CO., equipped every station on the line with MARLEY DOUBLE-FLOW HORIZONTAL INDUCED DRAFT cooling towers of the "SpraCoil" type— incomparable for all services employing atmospheric heat exchangers in the tower's base.

Get the complete details concerning Marley "SpraCoil" towers for cooling liquids and gas indirectly by water. In an endless variety of services—often several combined in one tower. Unlimited range of capacities—extreme operating flexibility.

MARLEY

Offices in Major Cities • Factories: Stockton, Calif., and K. C., K.

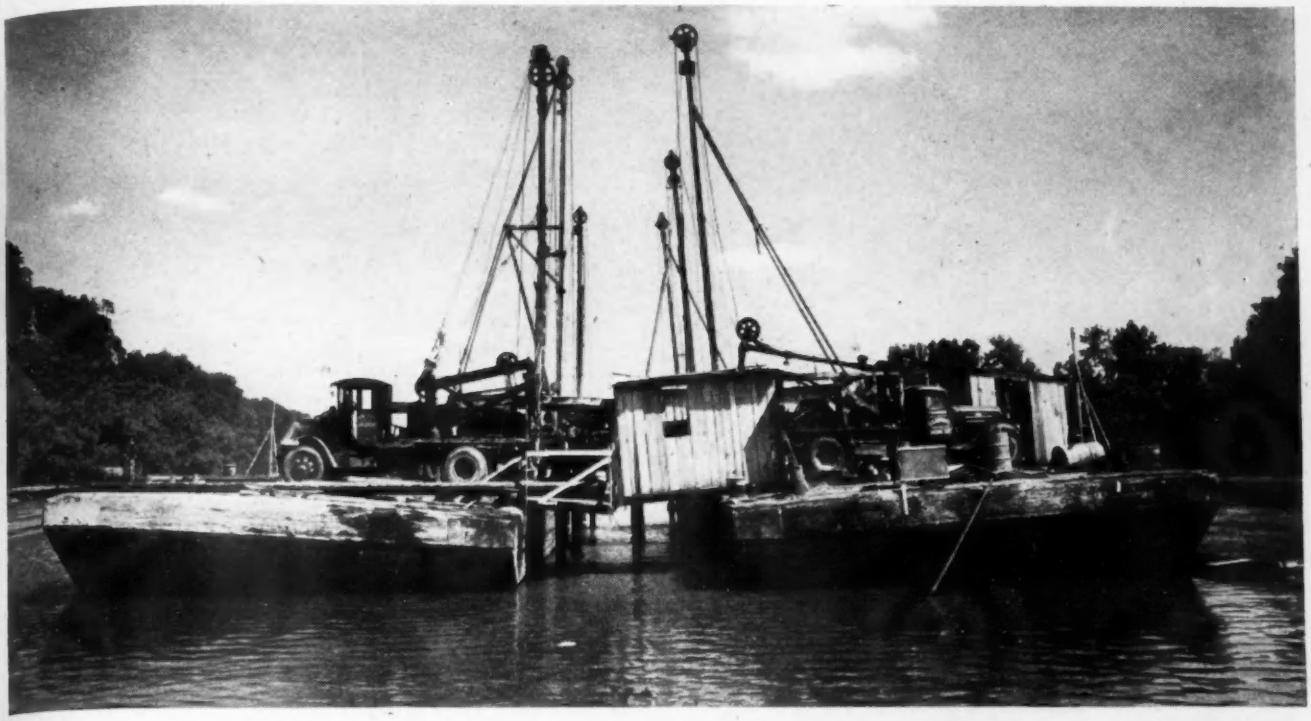
COOLING TOWERS

THE MARLEY COMPANY, INC. • Kansas City 15, Kansas

Although every effort was made to remove all mud dust or loose dirt from the line as the separate joints were aligned and welded into place, some rust formed between fabrication and final closure of the line. To protect station equipment from this and other abrasive materials in the line, a scraper or pig was run through each section. At left, the scraper is being lowered preparatory to being inserted in the end or a section of line, pressure behind the driving cups, forcing it through the line and sweeping waste materials ahead of it to the open end of the section being cleared.

☆ ☆ ☆

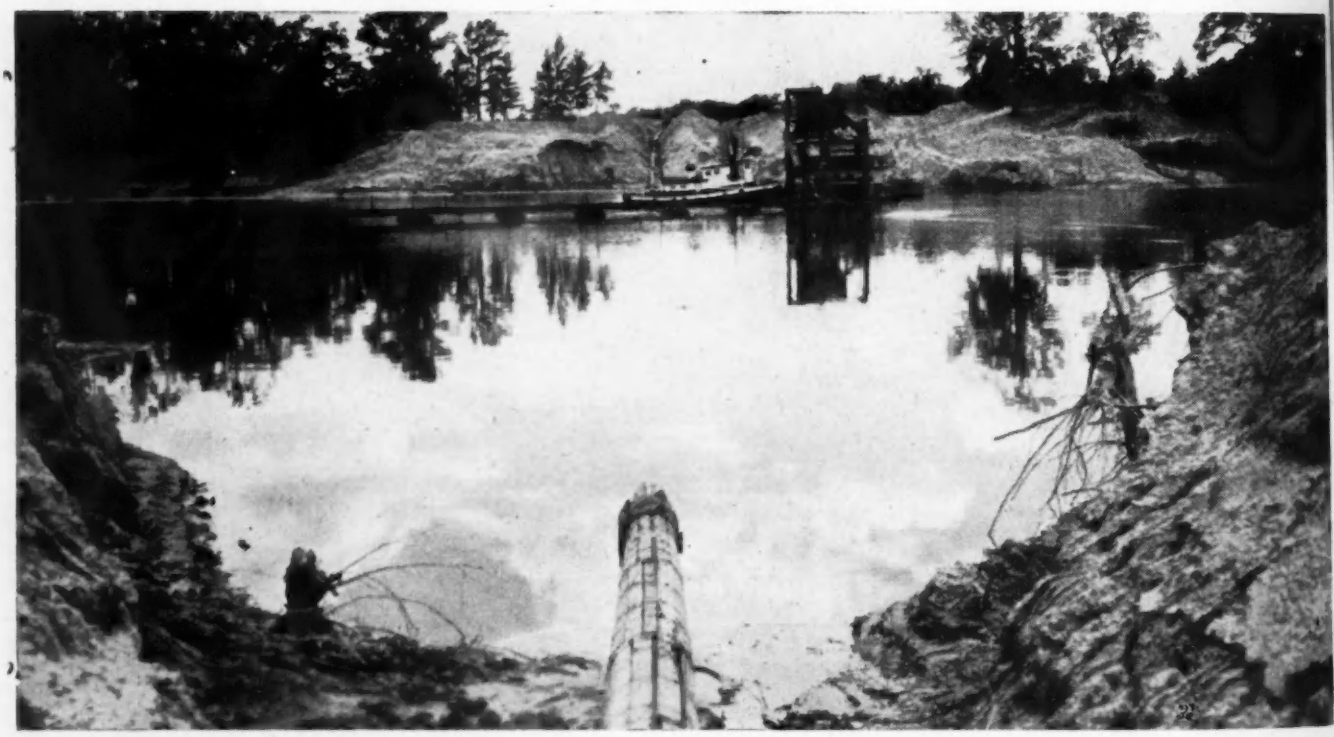
Need for a scraper and blow is evidenced by the dense cloud of dust and rust (below) issuing from the specially formed blow fitting which is inserted into the line through detachable couplings at the spots prepared for entering the line. These Y-fittings, blinded on one branch to the main line, in effect form an open section of the line between block gates, enabling it to be isolated for cleaning.



Rock-bottomed rivers, such as the Tennessee and Cumberland, required the blasting of a trench through the bed, involving sets as large as 15 tons of dynamite at a time. Shot holes for this trench were drilled and cased similar to those used on the "Big Inch," but were put down in much less time due to the improved handling of the spudders doing the actual drilling. Three machines were mounted at the edge of each of a pair of barges, lashed together so the holes drilled by the three pairs of machines would be properly spaced to provide the desired trench through the rock. Drilling the three pairs of holes at the same time, the barge setup would then move out across the stream to give proper shot-hole spacing, and another set drilled. The holes were cased well above the surface before the rig was moved, and the full depth assured for the placing of the specially prepared charges, which wired together, were detonated electrically.

Many of the river banks were so soft, and sloped so steeply to the water's edge, that special provision had to be made for cutting the trench. Back hoes were used to open out the deep V-shaped cuts for the placing of the manifolds, and for opening bell holes around the pipe as well as for the actual excavation of the trench to the point where dredging began. Spoil was removed with bulldozers.

Some of the rivers were so filled with buried logs and other flood-borne debris that only a dredge with bucket could cut the trench for the pipes of the three-branched crossings used on all major streams crossed below water level. Since many streams were classified as navigable, coverage demanded in some instances required deeper trenching than would have been required for normal line safety against flood scour. Barge spoil deposited on the river bottom during dredging was piled to present minimum obstacle to currents, and was used largely in covering the lines after they had been dragged across and placed according to navigational requirements.



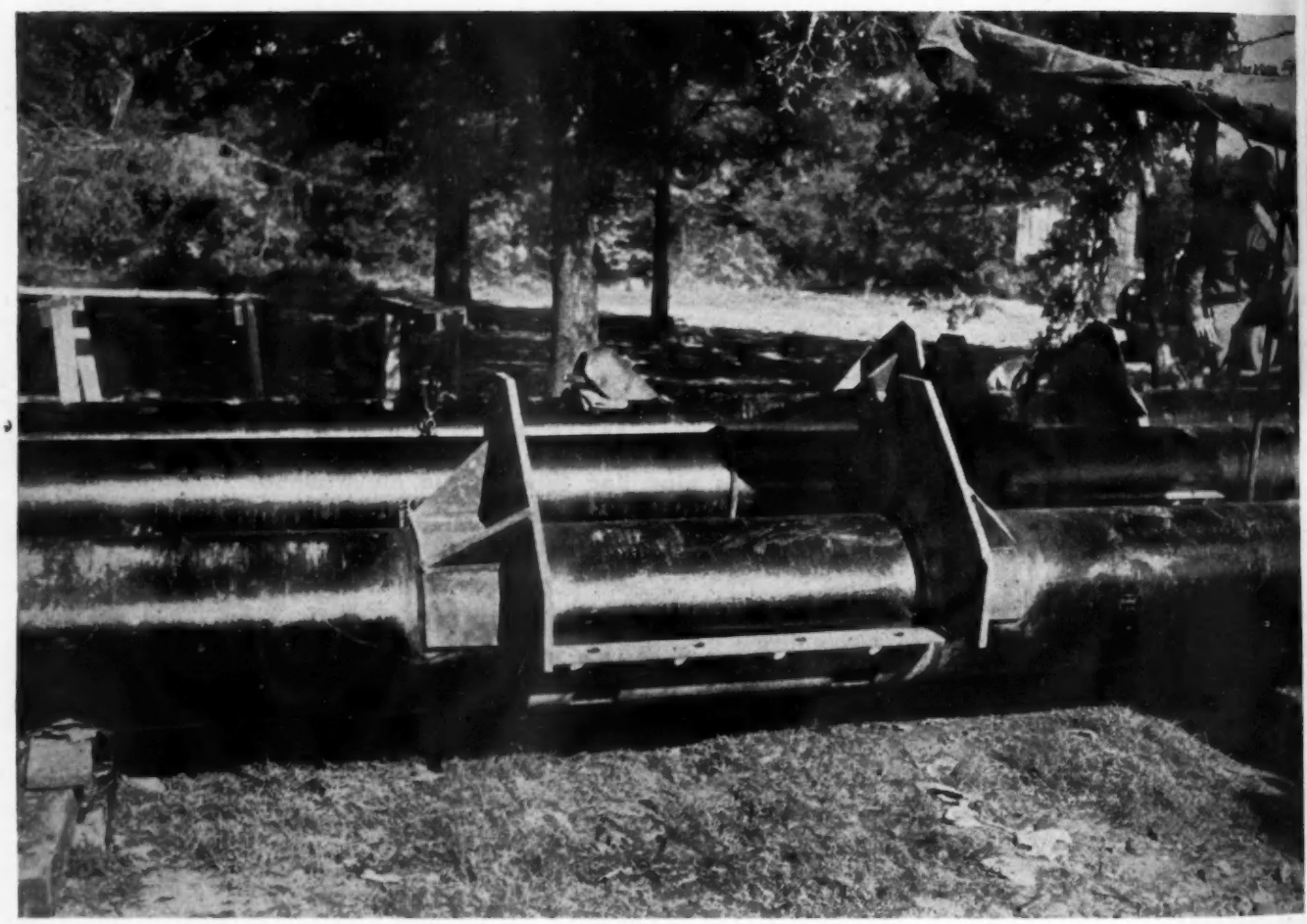
At the Ouachita all attempts at clearing a trench across the shifting sands which formed the river bed proved futile, and it was necessary to bring in a suction dredge and to work a trench across the steam through this means. Bottom was cut to required depth between a pair of the three crossing lines, and the pipe was allowed to find its way, through caving, to the bottom of the ditch. A second traverse of the stream by the dredge cut a second ditch, into which the line was allowed to slide as the bank caved away. Where full depth was not attained at the first pass, supplemental dredging soon cleared away the sand and permitted the desired grade to be reached.

Illustration is typical of the severe conditions combated by Bechtel-Dempsey-Price in the construction of 326 miles of the Tennessee Gas and Transmission Company's pipe line through the mountainous and rocky terrain of Kentucky, and swamps of Mississippi.

BECHTEL COMPANY
O. E. DEMPSEY CONSTRUCTION CO.
H. C. PRICE CO.

SAN FRANCISCO • TULSA • BARTLESVILLE

A river crossing manifold, following the usual pattern of two branches close together with the third at some distance down the tie-in member, is being doped and protected against corrosion before being skidded to place and welded to the crossing lines and the 24-inch main. Block gates on each tie-in, as well as a master gate on the 24-inch pipe, provide for complete closure of the line if needed.



Shown upside down, in the position in which the anchors were welded to the manifold, are a pair of the fabricated abutments which are fitted over concrete subbases and which are held in place through bolts. The flange extending between the two abutments rests on the concrete base, and is bolted with studs buried in the base. The entire layout provides ready access, with thorough anchorage.

RUBEROID

Plays its part!

Ruberoid Asbestos Pipe Line Felt, being applied on the new, record-breaking, natural gas pipe line of the Tennessee Gas & Transmission Co.

On pipe lines all over America, as on this latest "big inch," Ruberoid Asbestos Pipe Line Felt is doing its share to protect vital fuel arteries . . . just one of the many Ruberoid products giving indispensable service to the oil industry.

Ruberoid Asbestos Pipe Line Felt is specified by engineers because it gives maximum protection under the most severe conditions. It's chemically inert, moisture-resistant, protects from electrolysis.

For further details, write for our Industrial Bulletin "E."

RUBEROID

PIPE LINE FELT

Selling Agents for Oklahoma, Texas and Louisiana:
R. B. HALL AND COMPANY
Magnolia Building, Dallas 1, Texas

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Executive Offices: 500 Fifth Ave., New York 18, N.Y.
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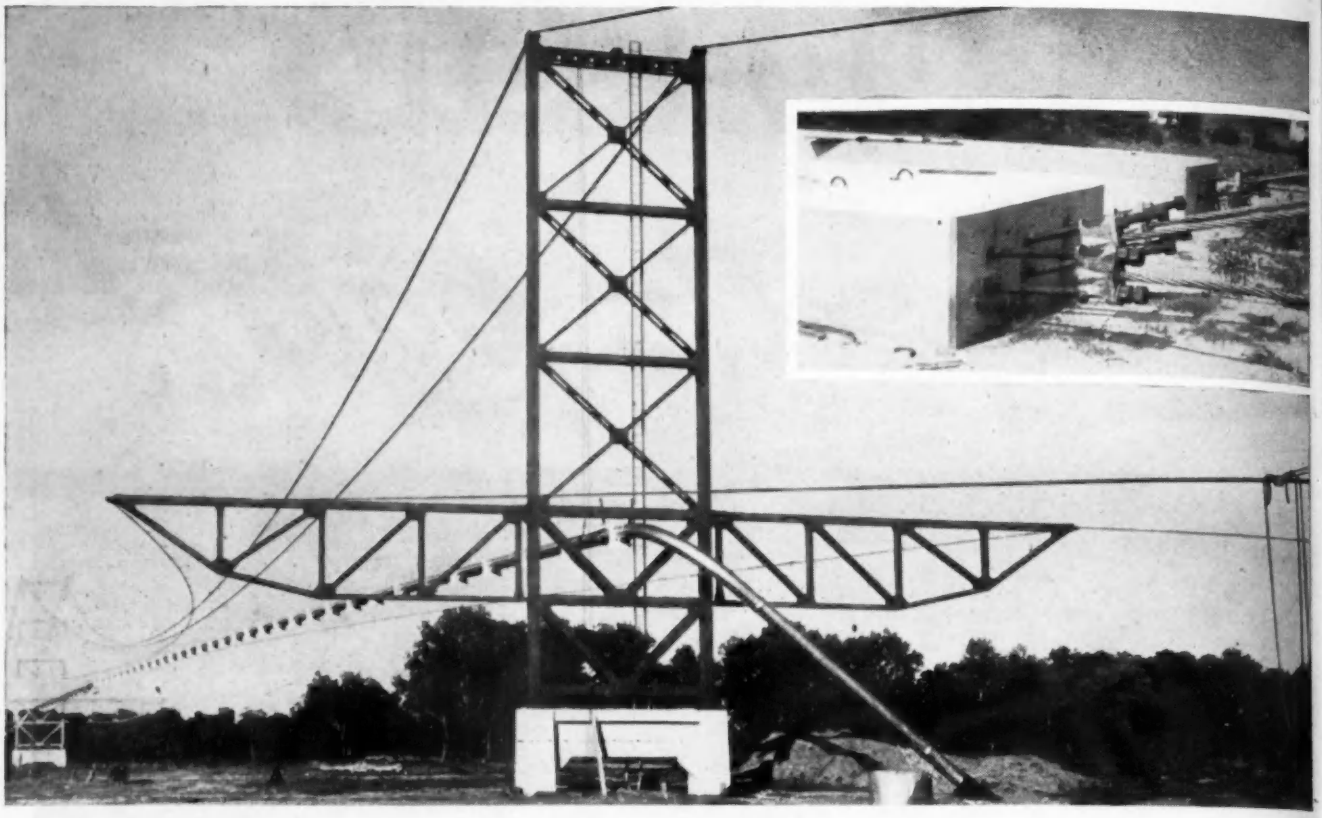
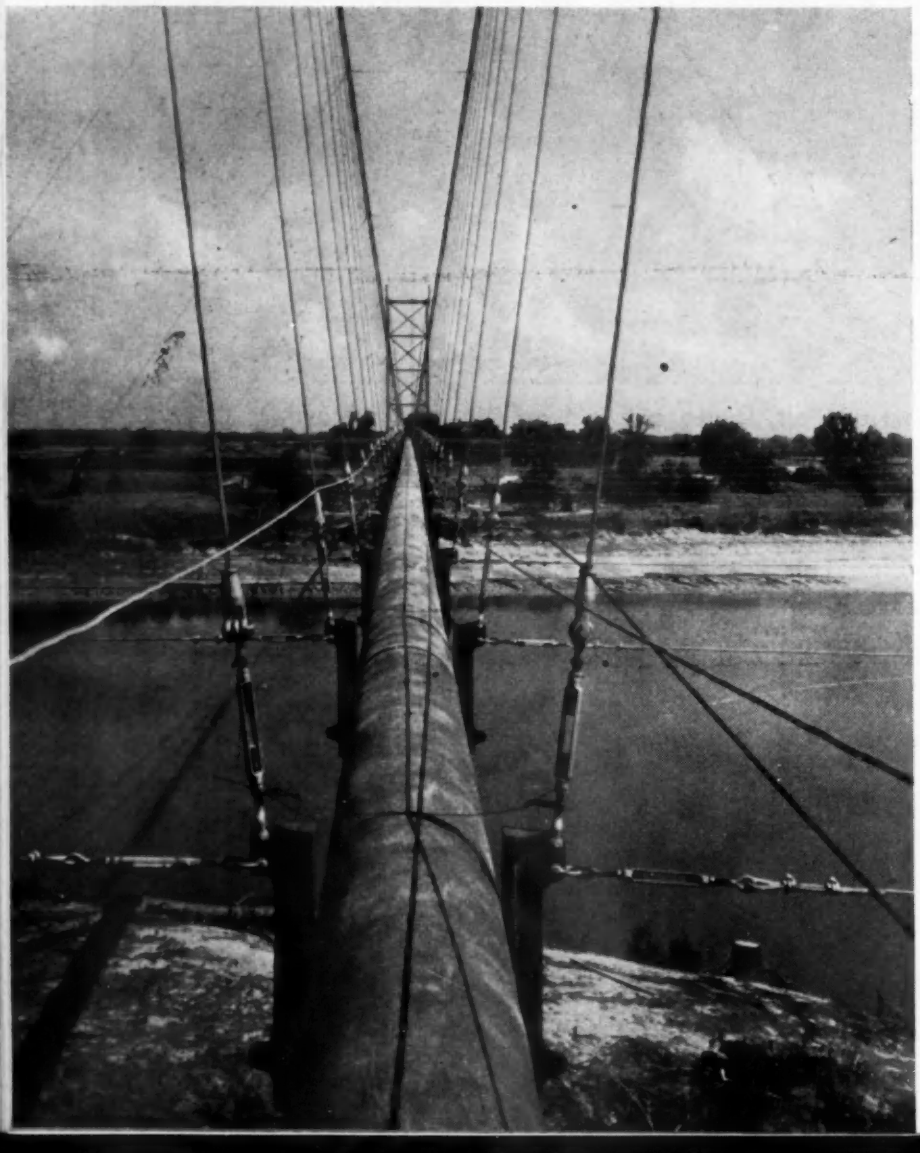
PIPE LINE MATERIALS, THERMAL INSULATIONS AND BUILDING PRODUCTS



Perhaps the most scenic portion of the entire line is the aerial crossings, used wherever conditions indicated instead of the more common river-bed crossing. Paired wire cables carry the suspension saddles, while single cables of the same diameter as the overhead units provide for wire stress and sidesway. The line is brought to the crossing with two wide sweep 90-degree turns, and all welds are protected by welding sleeves. Hand lines provide a catwalk in which the pipe itself is footing, upon which linewalkers may cross.

Anchorage of the big suspension cables (see insert above) calls for a block of concrete and means for securing the desired—and uniform—tension in all the six cables composing the supporting members of an aerial crossing. Here the socketed ends of the cables, made to exact designed length before shipment from the rope factory, are carried on parallel studs and held in place by lock nuts against possible vibration.



Well above floods and possible fouling by driftwood, this aerial crossing (left) spans the Red River near Nacogdoches, Louisiana, extending far out across the flood plain on the farther side to bring the pipe to earth again beyond danger of erosion. The view was made during construction, and before the handlines used had been replaced by those affording security for line walkers. Pipe for this crossing was welded on a platform at the river's edge, and was pulled through the saddles as each joint was added until the entire crossing was in place. The pipe rests in the saddles without anchorage, permitting shifting under expansion without stressing. The piers provide for two feet of shift of the last saddle lateraly without contact between structure ond the supporting cables.

Dowtherm on the job!

INSTALLED IN 1934

Efficiency Up—Costs Down

Ten years ago Dowtherm was a new development. Among the Dowtherm installations made at that time was one in the plant of a Midwestern oil processor. Prior to his adoption of the efficient Dowtherm heat transfer method, this producer of specialty oils had used a direct-fired system, with resultant shutdowns caused by burned-out kettle bottoms, charring and "coking-up" of the material, and even a costly plant fire.

But with Dowtherm on the job, this processor reports the saving of time . . . simplification of operation . . . highly accurate heat control, with changes rapidly effected when needed . . . complete elimination of forced shutdowns . . . and a reduction of 50% in operating costs.

This is actual experience; and it is *typical* among today's 400 Dowtherm users. If your operations involve the precise control of temperatures within the 400°-725° F. range . . . if you are looking for freedom from the dangers of high pressures . . . for production without interruption . . . for uniformity of product and the possibility of product improvement . . . for new substantial economies . . . then Dowtherm should have your attention. Dow is readily at your service with detailed data on Dowtherm liquid and Dowtherm vapor systems.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

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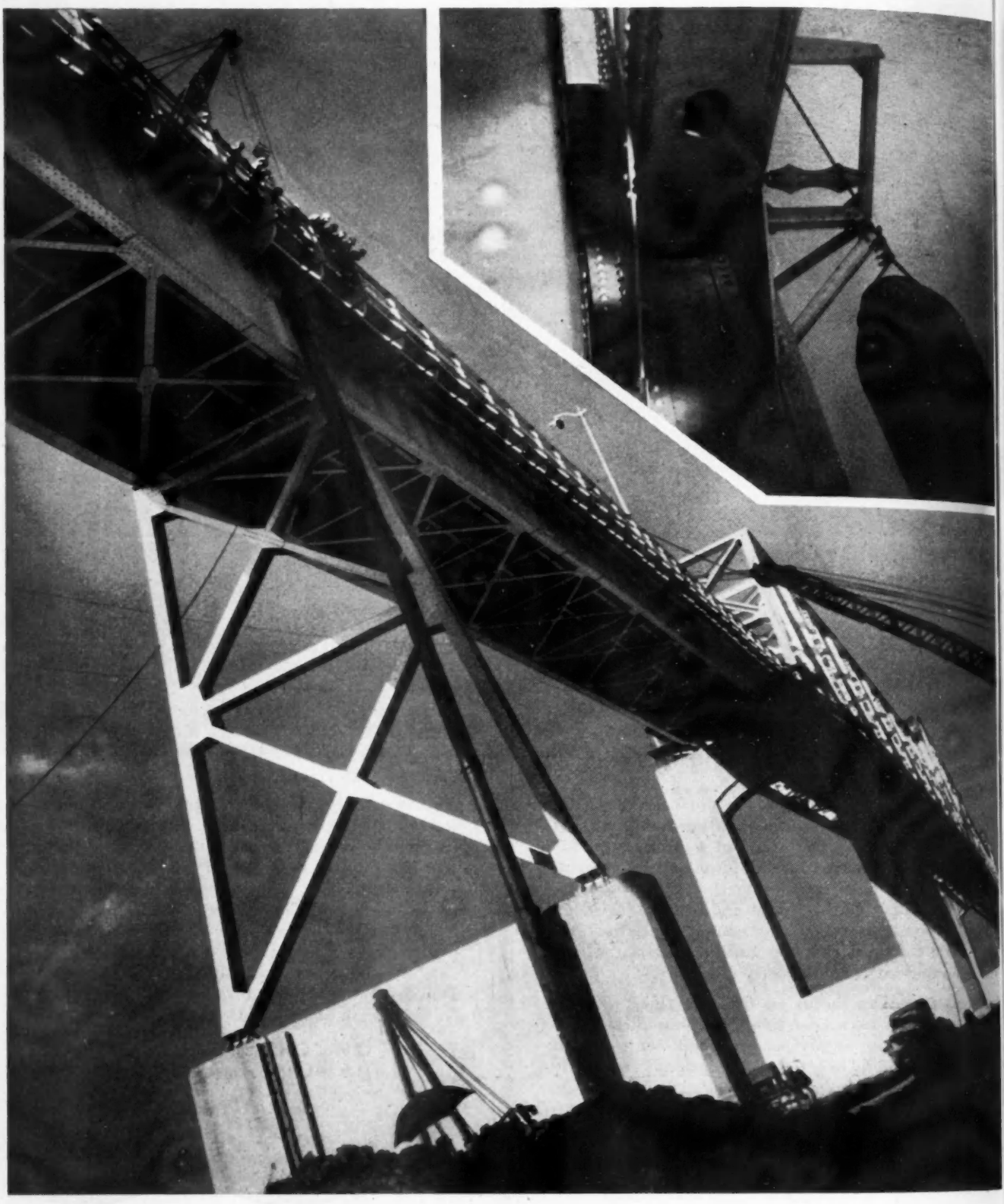
Dowtherm

The high-temperature, low-pressure heat transfer medium

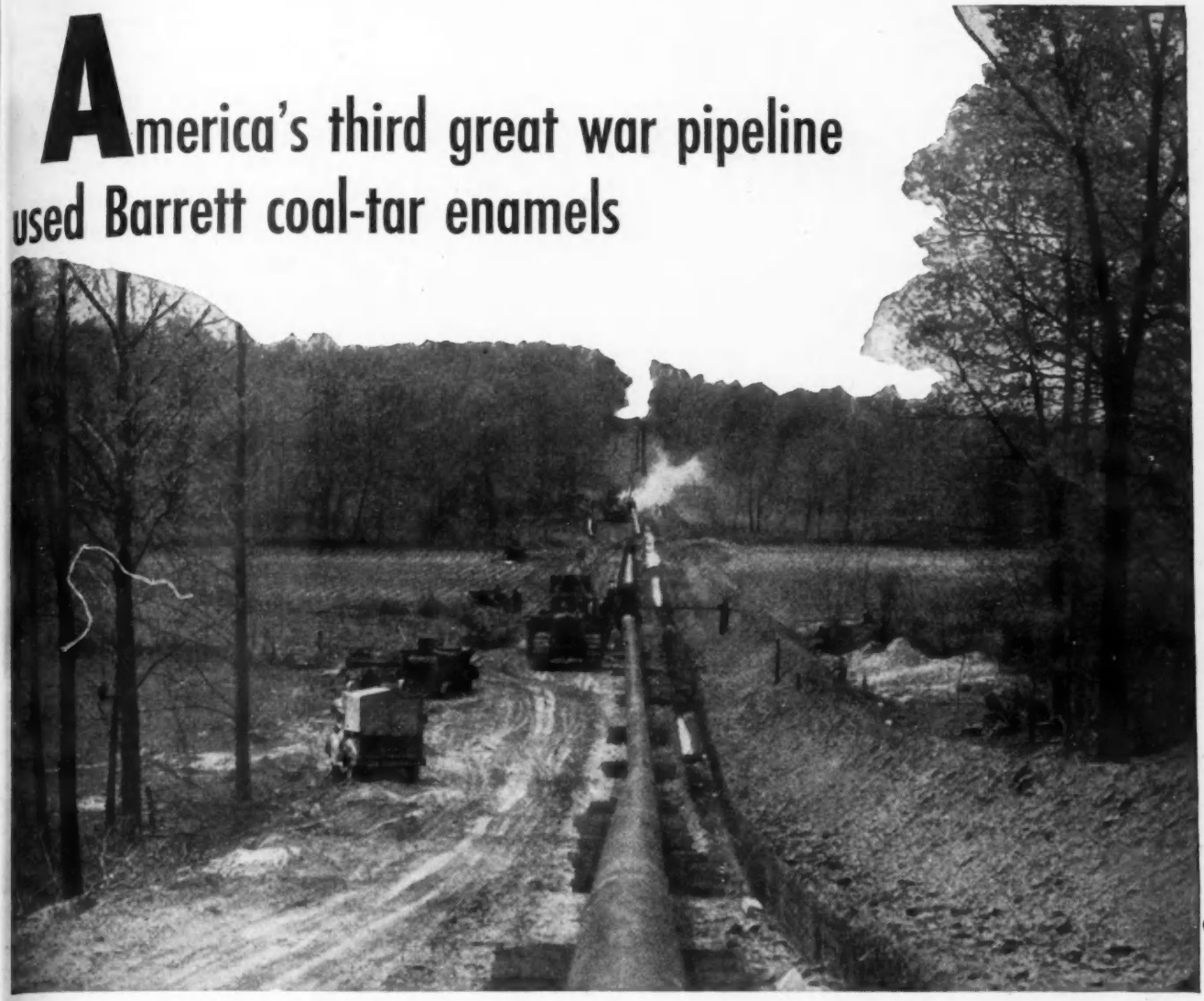
DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY



Old Man River was crossed on the Greenville, Mississippi, highway bridge, with a construction which varied somewhat from the usual suspension of a pipeline on a highway structure. The line crossed the river bed within the levees to the first approach piers away from the main spans, rising vertically at that point to the first bridge support, and continuing to the span, where an offset brought the line outside the truss members. A similar construction across the river brought the line down to a twin-pipe crossing of the island and back channel and a second climb up and over the high levee protecting against floods. Welds were joint-reinforced on this bridge. The line, welded joint by joint at one end on a platform similar to that used on aerial crossings, was threaded through the roller-supports by means of a winch line extending to a tractor at the opposite end of the highway bridge, as shown in the inset. The spool shaped rollers, carried within rectangular frames attached outside of the bridge trusses, provide for expansion change of the line without binding. To reduce as far as possible the dead load added to the bridge stresses, both the supporting frames and the rollers are made from a high-tensile aluminum alloy; use of this material also solving the problem of corrosion and possible binding of the rollers and consequent wear on the pipe wall as shifts occur.

America's third great war pipeline used Barrett coal-tar enamels



Built by Tennessee Gas and Transmission Company, from Corpus Christi, Texas, to Charleston, West Virginia

Here is the third great wartime pipeline project. As in the case of its two famous predecessors, "Big Inch" and "Little Big Inch," this newest artery is built for years of enduring service, and Barrett Coal-tar Enamels played an important part in its completion. More than two-thirds of this system is Barrett-coated.

Once again Barrett Coal-tar Enamels have answered the need for easy, speedy application and have met the most exacting standards of quality. Barrett Enamels resist underground acids, alkalis and electrolytic corrosion. They withstand unusual conditions of stress in all varieties of soil—hence assure maximum protection and minimum maintenance.

FIELD SERVICE—The Barrett Pipeline Service Department and staff of Field Service men are equipped to provide both technical and on-the-job assistance in the use of Barrett Enamel.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

Barrett
COAL-TAR ENAMEL

T-G-T System's Dehydration Plant

Located near Driscoll, Texas, plant is modern in design and has all approved features for safety and efficient handling of gas which is prepared here for transmission in 1265-mile line to West Virginia points. Duplicate regulators each to handle 225 million feet daily

By HAROLD F. DAWE
Gas Engineer, The Stearns-Roger Manufacturing Company
Denver, Colorado

and

HENRY N. WADE
Chief Engineer, Parkhill and Wade, Los Angeles, California

THE Tennessee Gas & Transmission Company's project to move natural gas from the Texas Gulf Coast fields to connections with the East's gas distribution systems centering in the East Ohio and West Virginia natural gas fields falls into two parts. These two are the dehydration plant and the compressor stations and line itself.

. The dehydration plant is designed to complete the process of preparing natural gas for use as a fuel. This process, begun by the well separators, is carried on by the high-pressure absorption plants through which the stripped gas is passed before being delivered to the initial installation of the T-G-T system.

At present, the gas enters three purchase gas metering stations under natural well pressure after it has passed through one of several high pressure absorption plants for extracting gasoline. The stations are located at the Wardner and Coastal recycling plants of the Chicago Corporation, and at the Gulf Plains plant of the Gulf Plains Corporation.

Plant Capacities

The Wardner and Gulf Plains metering stations each has a maximum 24-hour capacity of approximately 150,000,000 cubic feet, while the Coastal metering station may operate at an approximate maximum capacity of 75,000,000 cubic feet. Present demand on these three purchase gas metering stations will be approximately 225,000,000 cubic feet. From the purchasing stations, the gas enters a pipe system through which it is transferred to dehydration plant. From the dehydration plant it flows into the 24-inch pipe line and thence under its own pressure to the first of the compressor stations.

Design of Piping

Piping at the dehydration plant was designed according to Section 3, Division 2, of the Code for Pressure Piping promulgated by American Standard Association under the designation ASA-B-31.1-1942. This design made use of the standard set up in this section for oil and gase piping inside refinery limits.

The dehydration plant is 5 miles west of Driscoll, Texas, and is the gas source for the 24-inch pipe line. The gas entering the pipe line is dehydrated by passing through a diethylene glycol unit, designed for a working pressure of 840 pounds and will handle a maximum of 300,000,000 cubic feet of gas per 24 hours. The plant is designed to depress the dew-point of the gas processed about 50 degrees Fahrenheit below the incoming temperature, which will be 80 degrees Fahrenheit, or below, throughout the year. Thus, the dew-point of the gas in all parts of the system will not be over about 30 degrees at the outlet of the compressor stations and will fall below this temperature as the pressure drops between stations.

Experience has shown that this dew-point is adequate to protect against freezing or the formation of hydrates on all transmission lines, except possibly one or two in the coldest, most northerly parts of the country. The flow sheet for the dehydration plant is given in Figure 2.

The gas enters the dehydration plant through an 18-inch line reduced from 900 to 840 pounds through 8-inch pressure reducing regulators, in duplicate. Each regulator is designed to handle 225 000,000 cubic feet per 24 hours, with a 35-pound pressure drop. A bypass cuts out one or both of the regulators.

Dew-Point Depressed

The gas from the regulators enters an 18-inch header and flows into a battery of three contactors in parallel, where it is intimately contacted with concentrated diethylene glycol, which, being hygroscopic, absorbs moisture present in the natural gas, and, thus, depresses the dew-point.

The contactors are 78 inches in diameter and have a net shell length of 31 feet, 6 inches. The units each contain two scrubber sections and four contact trays. The contactors are of API-ASME code design, fully stress relieved and x-rayed.

The gas, on leaving the three contactors, flows through 12-inch pipe and a 12-inch meter run. There is a recording flowmeter on each run and a recording thermometer installed on two of the three runs. The recording thermometers are so arranged that one unit covers two runs for check purposes.

The gas leaving the meter runs is conducted through a header to a duplicate regulator setting where the pressure is reduced from 825 to 750 pounds per square inch gauge through either or both of two 8-inch pressure-reducing regulators in parallel. Each regulator is designed to handle 300,000,000 cubic feet of gas per 24 hours at 75 pounds per square inch gauge pressure drop. A bypass and block valves cut out one or both regulators. The gas from these regulators constitutes the supply source of gas for the 24-inch line.

The diethylene glycol from the contactors, slightly diluted with water, is drained from the contactors into a return line by a liquid level control mounted on the contactor. The glycol then flows to the heat exchange system, of seven shell and tube heat exchange units in series, where it flows through the tubes and is heated by the reconcentrated glycol from the still.

Glycol Further Heated

Between the second and third exchanger units in the series, the glycol is passed through a reflux condenser mounted on the top of the glycol still. This condenser serves to condense water reflux for the still from the water vapor, and further heats the glycol. This reflux condenser may be partially bypassed by a vernier hand control valve, as required. The glycol then returns to the third exchanger unit and flows through the remaining units, extracting additional heat from the lean glycol until it finally enters the glycol still feed tray.

The glycol still is 30 inches in diameter and has a net shell length of 32 feet, 6 inches, with a 10-foot skirt. The vessel has 15 bubble trays. The vessel is designed for a working pressure of 50 pounds per square inch gauge, and is equipped with a safety ladder leading to the platform and condenser support at the top.

A chordal weir baffle in the still serves to keep the glycol reboiler flooded over the level of the tubes, maintaining heating at maximum efficiency. The reboiler is of the vertical type and connects to the still by 12-inch top and bottom nozzles. It is 24 inches in diameter and has a net shell length of 6 feet, 10 inches. The shell thickness is ¼-inch. There are 454—¾-inch, 16-gauge tubes— 48 inches long installed between two tube sheets presenting an internal transfer surface of approximately 300 square feet. The

reboiler is designed for 50 pounds per square inch gauge working pressure at a temperature of 550 degrees Fahrenheit.

The lean glycol flowing from the base of the still enters a 60-inch diameter surge tank having a net shell length of 8 feet. This vessel is mounted horizontally to make the maximum use of the tank surge space, and serves to maintain an even head on the lean glycol through the heat exchangers, and to the suction of the glycol pump. It also acts as reservoir, or surge space, for the entire solution circulating system.

Pump Used

The lean glycol, after passing through the heat exchangers, is pumped back over the contactors. The pump used for this service is a 3¾ x 5-inch triplex plunger type, driven by a 40 horsepower, 440 volt, 60 cycle, open frame electric motor, with a complete spare unit.

The pump forces the lean glycol through a 3-inch discharge line to the contactors. The lean glycol flows through a flow recorder controller which records the exact total flow to the contactors. Also, on low glycol flow or failure, the controller operates an alarm whistle which warns the operator. From this point, the glycol flow is split over each contactor by means of an indicating flow meter with manual throttle valve.

For heating the glycol, there are installed two vertical vapor generators using a heat transfer liquid of high temperature boiling point. Each has a capacity of 1,000,000 BTU per hour, and is capable of maintaining the total plant heating load for a short period. However, the plant design anticipates the use of both generators in parallel under normal conditions.

These generators are equipped with safety valves, low level warning controls, and pressure controls. The low level control is connected to sound a warning signal on low liquid level. The pressure control switch cuts off the gas to the main burners when the desired pressure is reached, but leaves the pilots burning. Upon complete gas failure, the pilot valves close. Normally they are energized by an electric current generated through the heat of the pilot. The source of energy for the electric controls is a 6-volt heavy duty storage battery. This energy source has been chosen as most reliable and is independent of power failure to the plant.

Controlling Temperature

To control the base temperature of the still, there is installed a recording temperature controller with thermo bulb in the still base. The controller operates a throttling type diaphragm valve in the liquid return line to the boiler. Where the reboiler must supply more heat to the still base, the valve opens and allows a greater flow through the reboiler, the valve partially closing upon lower heat requirements, and thus flooding part of the reboiler surface with liquid.

The source of electric power is 440 volt, 60 cycle, alternating current purchased from the Coastal plant of the Chicago Corporation nearby. The generated power is transformed from 440 volts at the plant to 2300 volts, then transmitted to the dehydration plant, where it is stepped down again to 440 volts. This transformation saves approximately 4700 pounds of copper and is a less expensive installation than a complete 440-volt system. The 440-volt power enters the boiler building switchboard where it is metered and is distributed to the points of utilization. The switchboard is a completely unitized control center of the totally enclosed type.

A recording calorimeter and gravitometer are housed in a specially constructed room of the office building. The room has fully insulated walls and ceilings and has double windows. Doors giving entrance to the room slide rather than swing, thus creating less air disturbance. The calorimeter is used to determine and record permanently, in BTU, the calorific value of the gas entering the pipe line. The instrument gives results direct in BTU per cubic foot of gas at 30 inches of mercury pressure and 60 degrees Fahrenheit, saturated without any manual operation, computation, or correction of any kind.

The recording gravitometer gives an accurate permanent record of the gas going into the pipe line. For many years it was the common practice to test the gravity of gas sold at periodic intervals and use the value obtained to predict the orifice coefficient for orifice delivery meters for the ensuing period. The changing gravity requires a constant record in order to make an accurate measurement of the gas, and this instrument provides such a record.

All fuel used in the operation of the dehydration plant is metered through a dual installation of displacement meters and regulators, adequately safeguarded by pressure relief valves.

Congratulations to

TENNESSEE GAS & TRANSMISSION CO.

on the completion of this outstanding pipe line

Naturally we are proud that Horn Paints and Technical Coatings were selected and used on all the station and storage tanks on this great pipe line. The successful completion of this outstanding project reflects the highest credit on all executives, engineers, purchasing agents—all men, both supervisors and workers who have worked together in such effective cooperation.

HORN

A. C. HORN COMPANY

Petroleum Division Headquarters

HOUSTON, TEXAS

Manufacturers of Petroleum Industry Paints and Technical Coatings

Chicago **NEW YORK** **Los Angeles**

Branches in All Principal Cities

SOLD THROUGH LEADING SUPPLY STORES EVERYWHERE

POWER for Pipelines!

• INTERNATIONAL TRACTORS
• ENGINES • TRUCKS

N. A. Saigh Co., San Antonio and Houston contractor, had 11 International Diesel TracTracTors working on the Conroe, Texas, spread. Eight of them were TD-18s, two were TD-14s, one a TD-9. The TD-14 in the foreground, equipped with side boom, is cradling pipe for a welding unit. John Barbour, Iowa Park, Texas, contractor, did pipe stringing with his International Crawlers on this Saigh spread.

THE all-around power and performance of International Tractors, Engines and Trucks for pipeline work was again demonstrated on Tennessee Gas and Transmission Company's "Big Inch" gas line.

These versatile tractors, engines and trucks were well represented on the variety of jobs that goes with the construction of a major pipeline. There were right-of-ways to build; there was pipe to string, lay, bend and weld—all part of this gigantic project that stretched through seven states.

It was a gruelling grind, day after day, with no let-up. But Internationals delivered the goods wherever they were working.

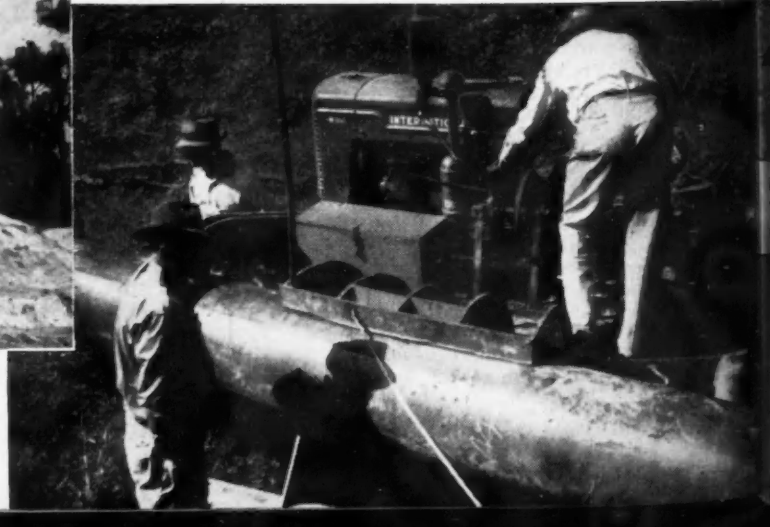
International Tractors, Engines and Trucks are geared to the needs of the oil and gas industry. Find out from the nearest International Industrial Power Distributor or Motor Truck Dealer how they can fit into your operations.

HARVESTER

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago 1, Illinois

Clearing and grading right-of-way was one big job assigned to powerful, rugged International Crawlers. International TD-18s owned by O. C. Whitaker Co., pipeline contractor, Fort Worth and Houston, are shown working on the Brown and Root, Inc., and O. C. Whitaker Co. spread.

Power for this pipe-bending machine on the J. R. Horrigan spread in West Virginia was provided by an International U-4 Engine.



International Trucks did their usual good work hauling and stringing pipe. Among the contractors who had Internationals on the Tennessee Gas job were J. R. Vandaveer and Son, Neodesha, Kansas (on the O. C. Whitaker Co. spread); C. Hobson Dunn, Dallas; and J. L. Cox and Sons (on the J. R. Horrigan spread). The International K-5 shown at right is owned by J. L. Cox and Sons.

When it came to welding pipe, International Crawlers were in there pitching. This TD-18 with side boom is owned by Pressure Weld Co., Houston, and is welding on the N. A. Saigh Co. spread.

A veteran International T-40 pulling auxiliary equipment for pressure welding near Soda, Texas. This tractor, owned by J. R. Vandaveer and Son, was photographed on the O. C. Whitaker Co. spread.

INTERNATIONAL HARVESTER

Power for Victory . . . Power for Peace

TRACTORS • ENGINES • TRUCKS

General view of dehydration plant, showing in the foreground the vaporization building, to its left the pump room for cycling glycol, and in the background the air-conditioned and soundproofed office. The stilltowers above its pressure tanks and battery of heat exchangers, flanked on the right by the three contactors, each equipped with automatic regulation to provide glycol flow and proper dehydration of gas, the plant being designed to lower the dew point of incoming gases 50 degrees, F., below that of the incoming temperature. This drop provides for ample protection at compressor station discharge pressures, with additional protection against formation of hydrates as pressure drop along the line still further widens the spread between moisture point and temperature. The plant has a total capacity of 293,500,000 cubic feet per 24 hours, which will not be reached until compressors are added.

Gas entering the dehydration plant passes through these two regulators, corrected individually across the 18-inch field line so that flow may be regulated from line pressure of about 900 pounds to the dehydration plant requirement of 840 pounds. The pressure reglators are each equipped with check valve to prevent back flow, and are equipped with block gates on either side of the regulating unit. A third line permits bypassing one or both of the regulators with gas when desired. At the right is shown the manually controlled vent line on the plant end of the reduction system, behind it appears the vent for the incoming line, while the paired automatic relief valves with short discharge stacks show at the rear of the assembly. These latter are set to protect against the surge.

Well-Placed Confidence in High Strength Pipe

WE CONGRATULATE the management and engineers of the Tennessee Gas and Transmission Company upon the completion—in record time—of America's longest gas pipe line. And we congratulate them for their confidence in the 24″ x ¼″ high strength, light wall SMITHway Pipe used for 900 miles of this line.

That confidence is soundly based on their knowledge of the engineering facts and the welding methods, the uniformity of pipe thickness and consistent physical characteristics of SMITHway Welded Line Pipe.

It is a confidence ably supported by the outstanding performance record which SMITHway Welded Pipe has established, so well, over a period of many years.

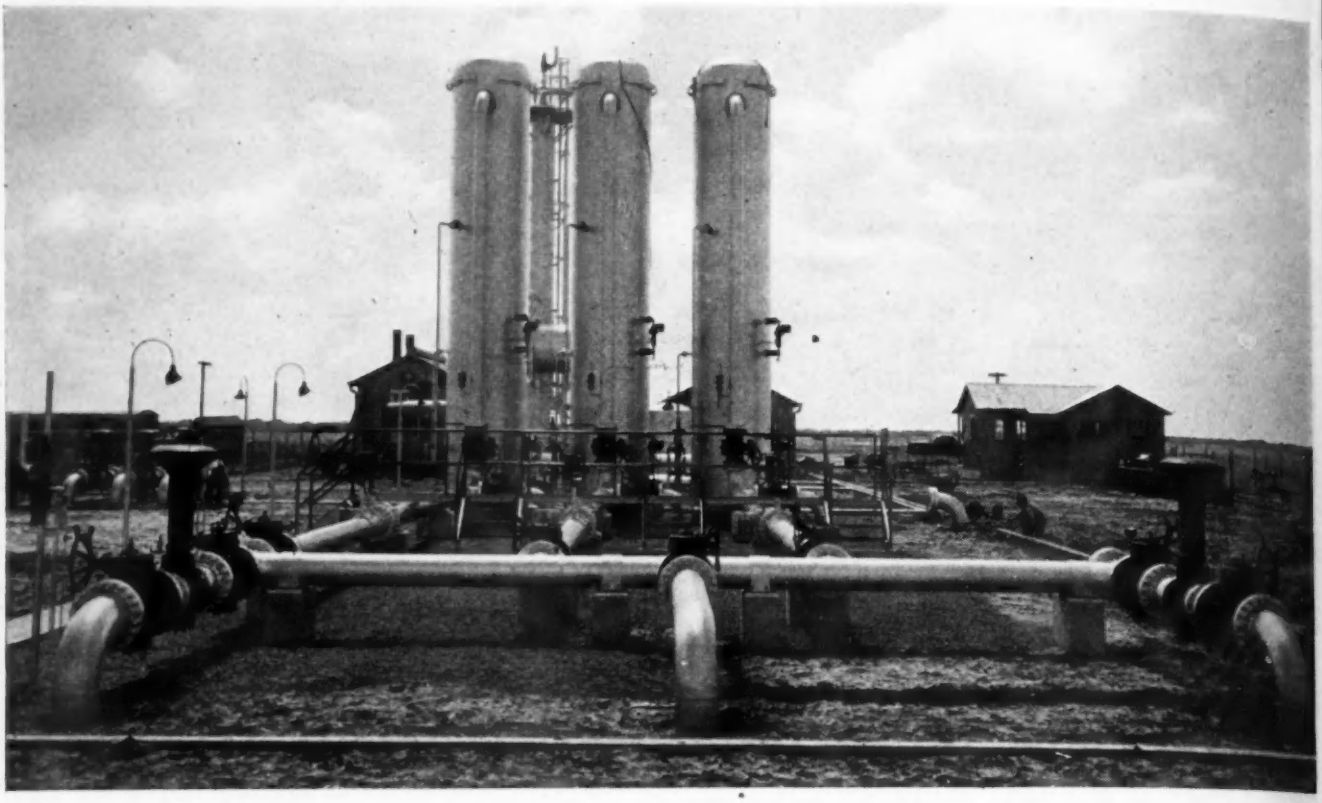
Have You Bought an Extra War Bond This Month?

ELECTRIC-WELDED LINE PIPE

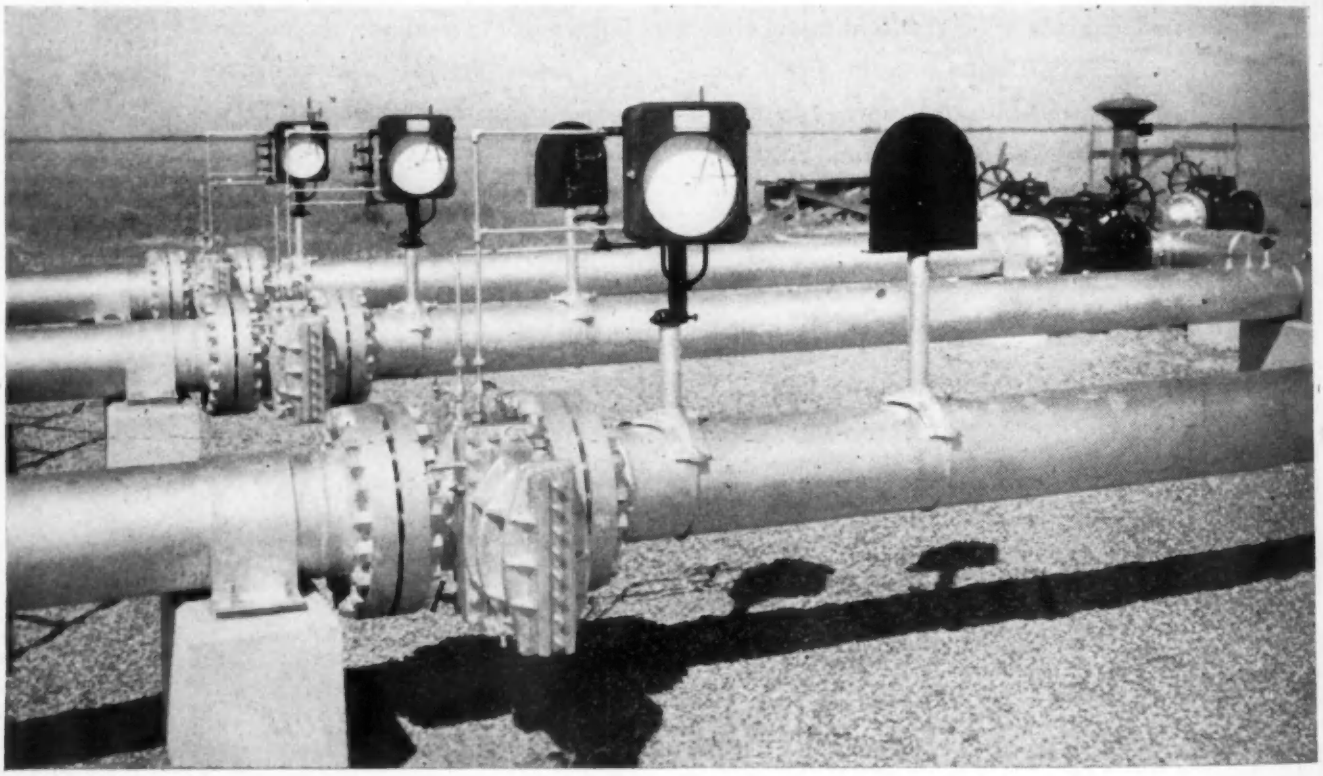
A. O. SMITH Corporation

MILWAUKEE 1 • WISCONSIN

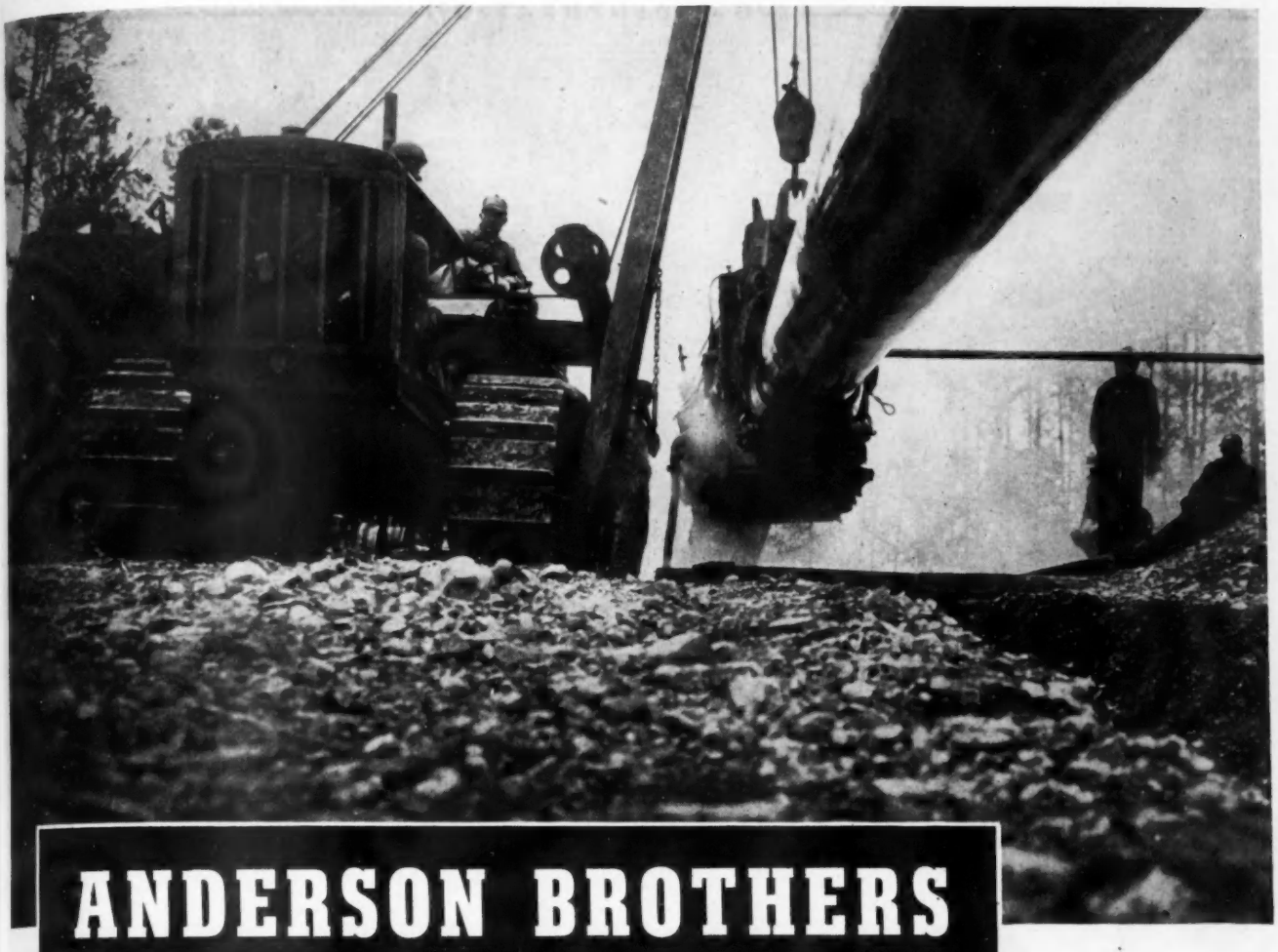
Offices at: NEW YORK • PITTSBURGH • CHICAGO • TULSA • HOUSTON • DALLAS • LOS ANGELES • SEATTLE • In Canada: JOHN INGLIS CO., LIMITED



The three contactors all but hide the glycol still, standing some 34 feet in height, with a diameter of 78 inches. Each unit contains two scrubber sections and four contact trays for insuring intimate contact between gas and glycol. Gas leaving the contactors passes through the 12-inch flow lines through recording flowmeters and past recording thermometers so arranged that one unit will cover two runs for check purposes. Block gates and a cross manifold permit either of the delivery pressure reducing units to be cut out, the pressure being reduced from 825 pounds to 750 pounds, which is the initial line pressure and carries to the first compressor units.



Each delivery run is equipped with orifice meter, each with recording equipment to provide immediate and complete flow data on gas passing through each contactor unit. The line is supported on concrete piers, held by formed clamps which restrain lateral motion, but which permit adequate lengthwise shifting under temperature differences without binding or stressing instrument mountings.



ANDERSON BROTHERS
furnishes equipment for construction of
TENNESSEE GAS TRANSMISSION LINE

Construction of the 24 inch T-G-T gas line required much specialized and extra heavy equipment. During our many years of pipe line construction, we have assembled a large amount of standard and specialized contractors equipment, which we placed at the disposal of those engaged in the construction of this huge line. As a result, we were able to help materially in completing the line ahead of schedule.

These and other builders of the T-G-T gas line were furnished equipment by Anderson Brothers.

N. A. Saigh
O. C. Whitaker
Brown & Root, Inc.

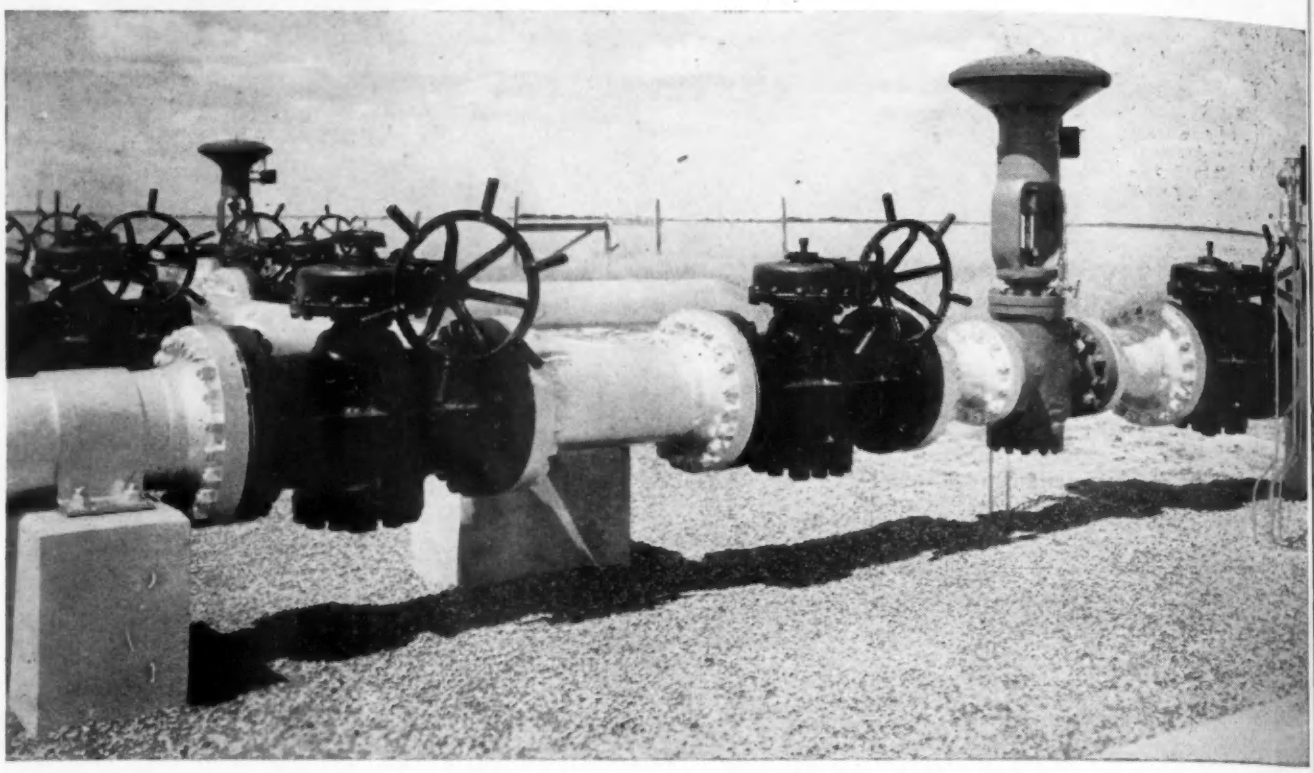
Joe R. Horrigan
Mid-Western Engineers & Contractors
Pittsburgh-Des Moines Steel Co.

ANDERSON BROTHERS
PIPE LINE CONTRACTORS

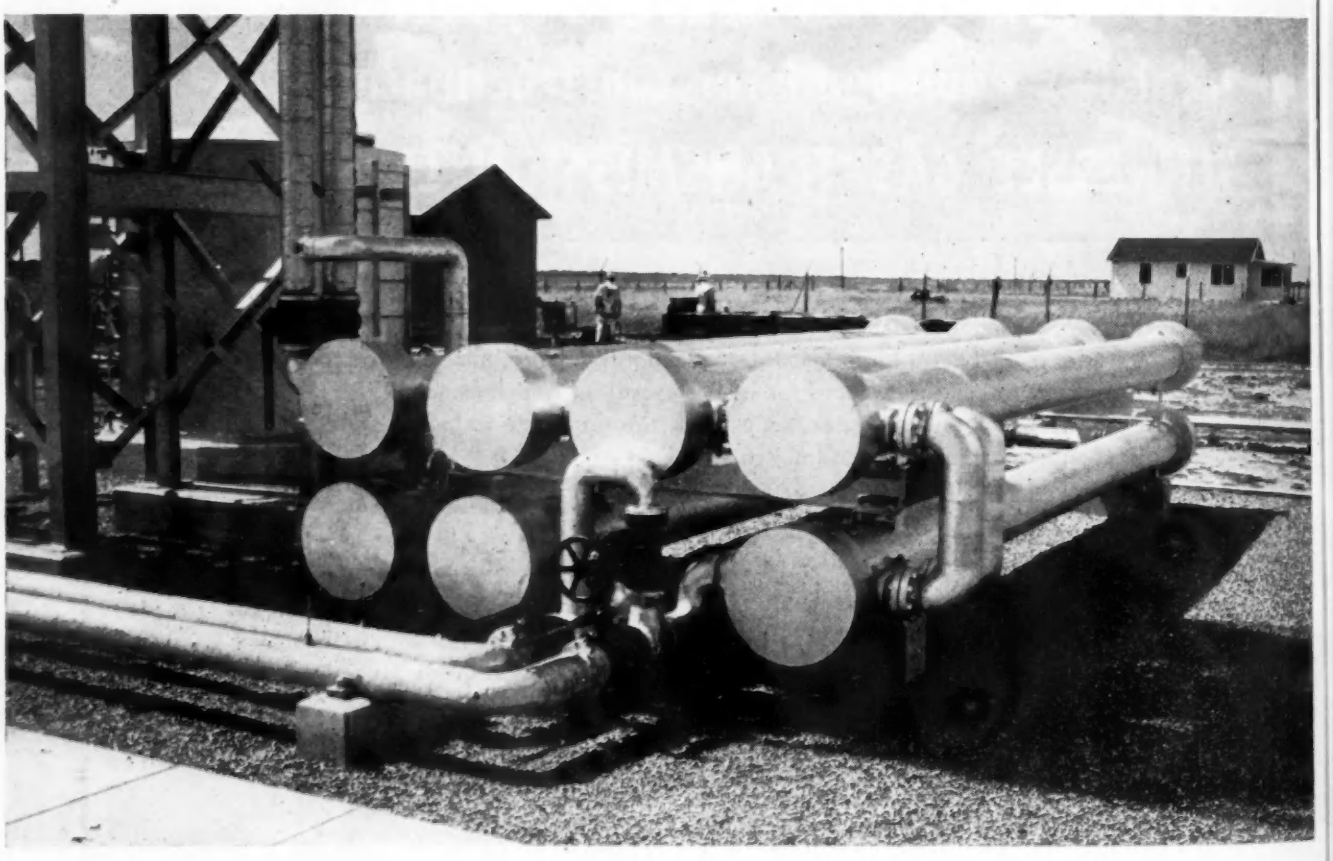
503 National Bank of Tulsa Bldg., Tulsa, Okla.

707 N. Drennan St., Houston, Texas

Oil City Pennsylvania



Each delivery run requires a full set of block gates at regulator and by pass manifold. Here the three valves are, left to right, line block, regulator protection, and back-pressure block, with the 300,000,000 cubic foot regulator supported between the latter pair of valves. Supported to relieve valves of pipe weight, the entire system is free to expand as necessary without stressing joints.



Completely enclosed in insulating material, the heat exchangers on the glycol line do not show in detail the manner in which the bank is tapped to provide for maintaining reflux temperature from the setup. Flow from the reflux unit enters the remaining exchangers of the bank, extracting residual heat from the glycol up to the point where it enters the glycol still feed tray for reconditioning.

★

A GREAT AID TO THE WAR EFFORT . . . AN IMPORTANT ASSET TO SOUTH TEXAS

★

THE momentous achievements of the Tennessee Gas & Transmission Company does even more than permit the economical distribution of a Texas resource to her easterly neighbors . . . It will create new wealth in Texas through the conservation and sale of natural gas . . . It will provide a necessary fuel to plants in the Appalachian territory, thereby speeding up war production and hastening the day of Victory.

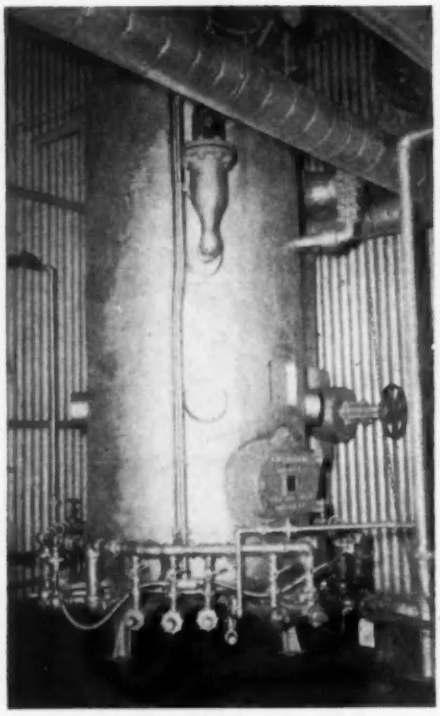
We are proud to be associated with a project so significant to the war effort and to the welfare of this community.

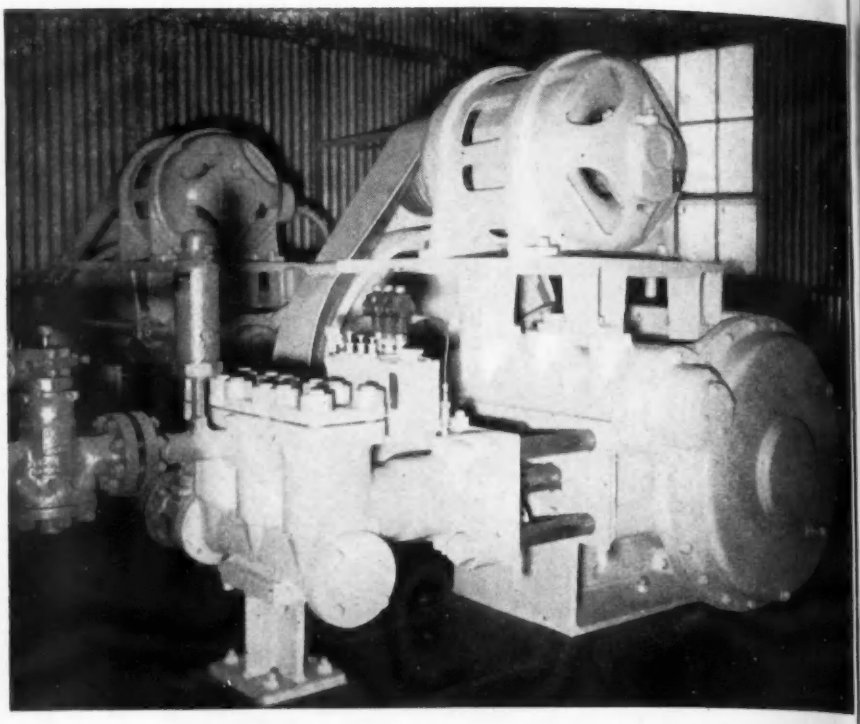
The NATIONAL BANK OF COMMERCE

Gulf Building Houston

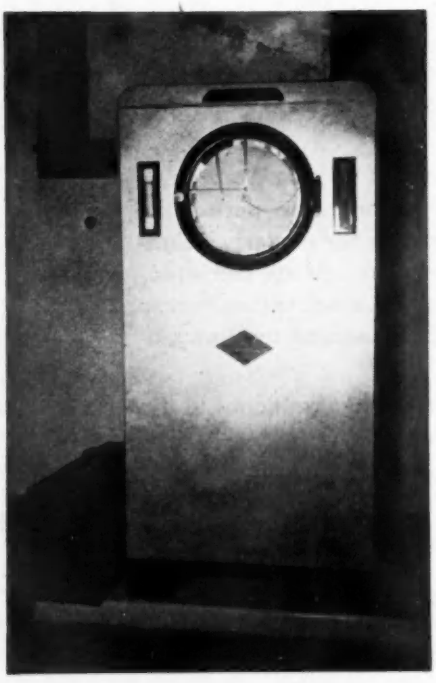
"The Bank of Courtesy"

MEMBER OF FEDERAL DEPOSIT INSURANCE CORPORATION

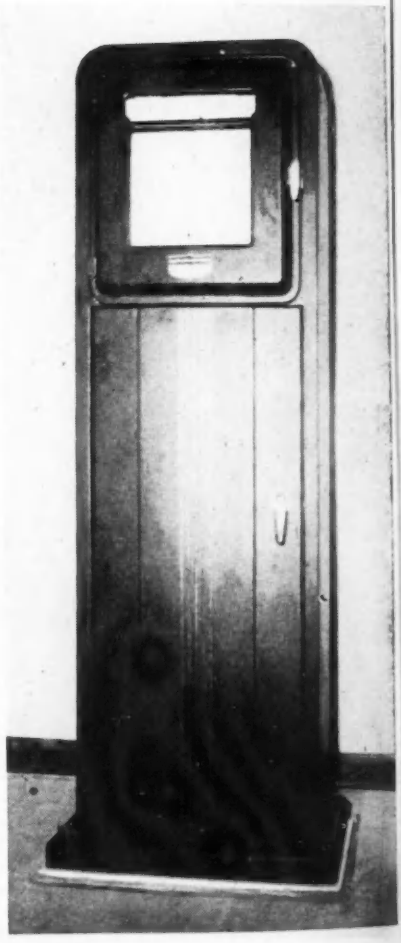




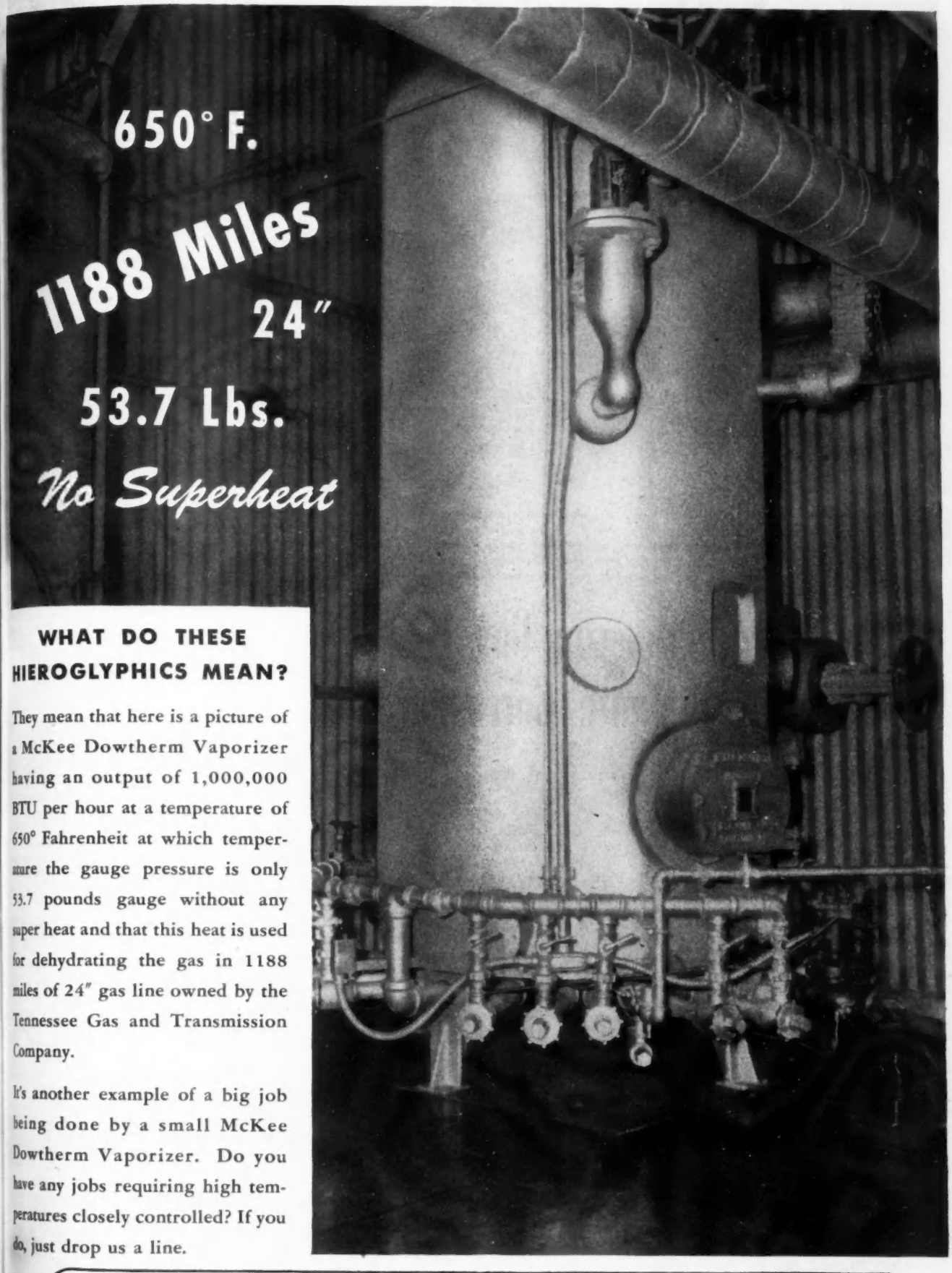
At left is the vaporizer in which the water-laden glycol is heated before passing to the still for separation. The unit is gas fired, and provided with a sensitive electrical device for cutting off pilot lights in case of gas failure. The reboiler contains 454 tubes, with a combined heat transfer surface of 300 square feet, for 50 pounds working pressure with a working temperature of 550 degrees F. At right is the motor-driven pump which forces the lean glycol through a 3-inch line to the contactors. The unit is a 3¾ x 5-inch triplex plunger pump, driven by a 40-horsepower, 440-volt motor, with ample pressure reserve to insure circulation against highest working pressures in the contactors. The pumping unit is duplicated throughout, to provide standby ready to tie into the system in case of emergency need.



A recording gravitometer, to provide an accurate permanent record of the gravity of the gas entering the line, occupies a fully insulated and sound-proof room in the office. This device supplants usual practice of obtaining intermittent gravity determinations through periodic sampling of the plant throughput. The unit is mounted on a heavy concrete base, extending well below the building foundation line, and entirely independent from it.



Two units (above and right) comprise the recording calorimeter, these being set likewise in an insulated, isolated room so as to minimize the effect of vibration and air currents. So carefully are these instruments safeguarded that the doors to these rooms, instead of swinging, are made to slide into the wall, as offering less air disturbance. The calorimeter records permanently, in Btu, the calorific value of the gas entering the line. The readings are direct in Btu per cubic foot at 30-inches of mercury and 60 degrees Fahrenheit, saturated, without manual operation, computation, or correction of any kind. The two units are mounted close together, but on separate bases to permit accurate levelling independent of possible shift in foundations, and connections are made flexibly to insure against distortion.



WHAT DO THESE HIEROGLYPHICS MEAN?

They mean that here is a picture of a McKee Dowtherm Vaporizer having an output of 1,000,000 BTU per hour at a temperature of 650° Fahrenheit at which temperature the gauge pressure is only 53.7 pounds gauge without any super heat and that this heat is used for dehydrating the gas in 1188 miles of 24" gas line owned by the Tennessee Gas and Transmission Company.

It's another example of a big job being done by a small McKee Dowtherm Vaporizer. Do you have any jobs requiring high temperatures closely controlled? If you do, just drop us a line.

Eclipse Fuel Engineering Company
ROCKFORD **ILLINOIS**

McKee Eclipse

Trying to get a protest from the pipe. This "jeep"—no relation to the army vehicle of the same name—is brushed along over the coated pipe and, through battery and proper amplifying apparatus, emits a loud and agonizing moan or squawk whenever one of the hundreds of contacting fingers finds even a microscopically tiny pore through the coating. This type of testing unit, although requiring more men and equipment than the type in which a spark is emitted at a break, is operative and effective under all types of lighting and does not depend upon visual evidence. To prevent backtracking of the dope gangs, the instrument follows closely behind the coating and wrapping spread.

Cathodic Protection on Gas Line Will Help to Minimize Corrosion

By STARR THAYER, Consulting Engineer, Houston, Texas

THE Tennessee Gas and Transmission Company's new line is one of the longest large lines ever built. Starting in the vicinity of Corpus Christi and ending in West Virginia, the pipe traverses every known type of soil common to the Gulf Coastal plain and the lowlands of the Mississippi delta, as well as the clay hills and hard rock slopes of Tennessee and Kentucky. Many miles of the line are laid in what is known, from past experience, to be from mildly to highly corrosive. Profiting by this knowledge, and supplemented by tests made at intervals along the right-of-way, thorough protection against corrosion was an early consideration in the layout, design and construction of the trunk line and the 7 station networks of gas manifold and feeder lines.

The line was coated with a cold primer, applied immediately after cleaning the pipe of rust and dirt, and this applicaiton was followed as soon as practicable with a coating of hot coal tar enamel and asbestos felt wrapper from the southern end at the dehydration plant up to the Dix river, in central Kentucky. Beyond that point three separate sections aggregating about 40 miles, were coated. No attempt was made to localize limited "hot" areas and to do any spot coating as protection against them.

Every effort was made to obtain as perfect an applicaiton of protective coating as possible. However, in spite of every precaution there undoubtedly will be some skips or faults in the application. Then, even though the coating may have been tested and proven adequately covered while the pipe is still at rest on the skids, there is possibility of fracture, chipping or rupture of the coating during the laying or backfilling operations. Also, when the line crosses abrupt hillsides, there is possibility of coating damage as the line adjusts itself to the slope, through contact against sharp edges in the rock occurring from insufficient or flushed out mulch. It is the purpose of the cathodic protection to eliminate corrosion at these uncoated areas, both those existing as the line is laid, and those which may develop during the service life of the installation.

A few tests have been made to determine the current required to cathodically protect the line and these illustrate the excellent coating job which has been obtained. At one test it was necessary to apply only 4.5 amperes to protect 22 miles of main line. At another test a considerable amount of station piping and 30 miles of line were protected with 22 amperes. When it is considered that this is a 24-inch line such current requirements seem small indeed.

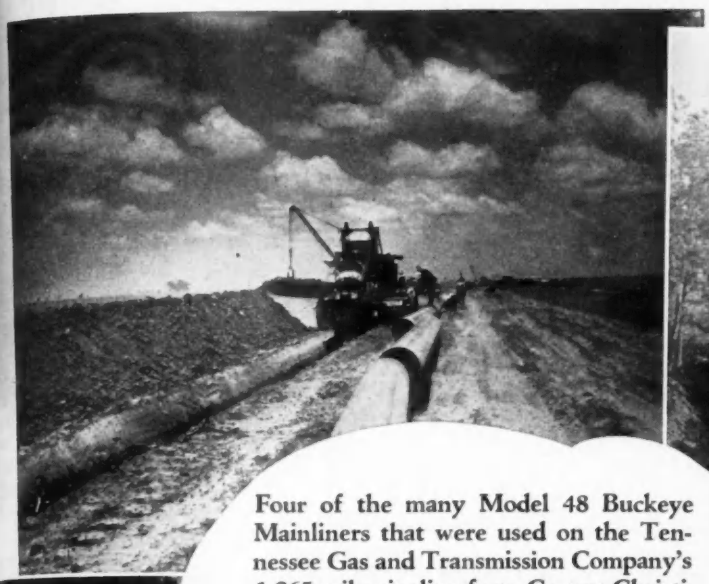
A 100-ampere protection unit has been erected at each compressor station and at the south end of the line, a total of eight units. It is thought that these units will protect the station piping, all of which was coated, and an undetermined number of miles of main line. These units have not as yet been placed in operation. When they are, working tests will be made to determine the number and size of units necessary to complete the protection between stations. If all the line tests out as well as the two illustrations described above but few such additional units will be required.

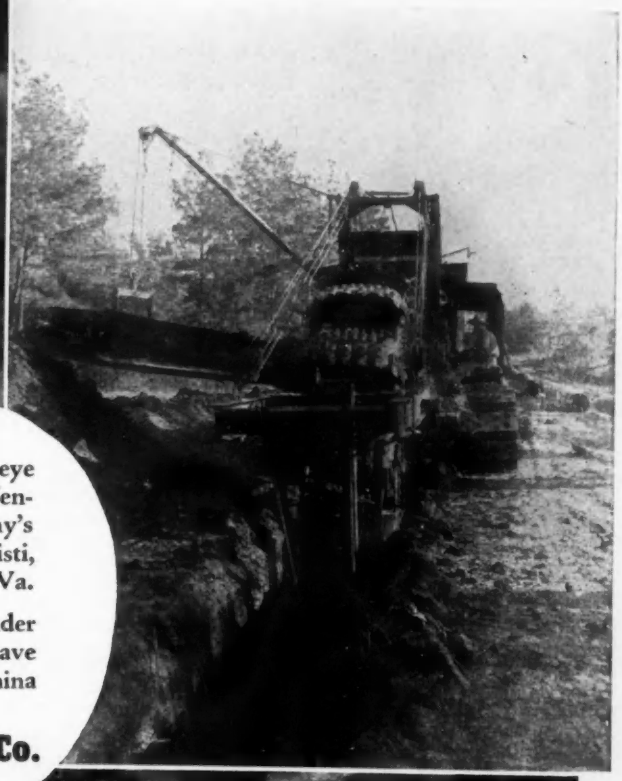
The pipe protection units now installed are of the copper oxide type and are oil immersed. It has been found that in the lower Gulf Coast area atmospheric corrosion is rather severe with the result that there have been frequent unit failures. It is thought that this will be eliminated with the oil immersed units. Vertical type ground beds have been used. These were located on company property and so placed that the vertical pipes could extend above the ground level and not be in the way of other operations.

The installation at the dehydration plant not only affords current for protection of the field lines entering the plant and the main line eastward, but, through a complete linking of all pipe lines in the vicinity with welded or brazed bonds and jumpers, the entire area is safeguarded against the influence of tramp currents and possible localized corrosion. The ground bed at this point is composed of a horizontal pipe buried roughly parallel to the main line, and having welded to it at intervals the vertical units which are driven deeply into the soil at that point. The rectifying unit is mounted on a broad concrete slab adjacent to the grid.

With the pipe protection now installed and with the possible addition of a few more units, corrosion losses on this line should be reduced to a very small amount. It is probable that these losses will never be a serious problem on this line.

Buckeye Trenchers on the "Tennessee Gas Line"

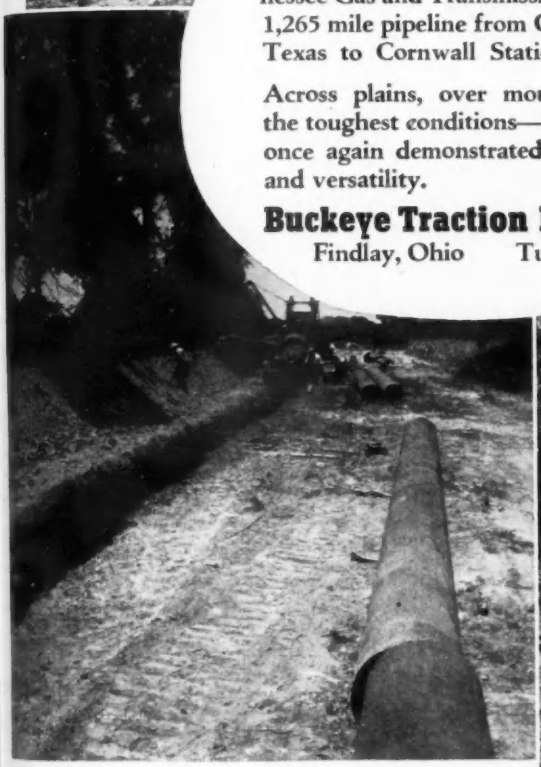




Four of the many Model 48 Buckeye Mainliners that were used on the Tennessee Gas and Transmission Company's 1,265 mile pipeline from Corpus Christi, Texas to Cornwall Station, West Va.

Across plains, over mountains, under the toughest conditions—Buckeyes have once again demonstrated their stamina and versatility.

Buckeye Traction Ditcher Co.
Findlay, Ohio Tulsa, Okla.



Built by **Buckeye** ✓

Convertible Shovels Road Wideners Trenchers
Spreaders R-B Power Finegraders Tractor Equipment

Compressor Stations Along T-G-T Line

Seven stations are built at 169-mile intervals. Present design calls for a delivery of 207 million feet per day but ultimately this figure will be upped to 262 daily. Rigid piping code is followed

By HAROLD F. DAWE
Gas Engineer, The Stearns-Roger Manufacturing Company
Denver, Colorado
and
HENRY N. WADE
Chief Engineer, Parkhill and Wade, Los Angeles, California

CONSTRUCTION program of the Tennessee Gas & Transmission Company 24-inch pipe line included seven compressor stations and a dehydration plant. In the seven stations, six will recompress the gas through approximately the same ratio at 1.86, while the last station will compress the gas to two different pressures at approximately 900 pounds and 475 pounds for split deliveries into the receiving systems. The gas will move into the dehydration plant under its own pressure to the suction side of the first compressor station located about 160 miles down the line. The average spacing between stations is about 169 miles, with the spacing slightly increasing with increasing distances from the source. The stations were spaced according to calculations based upon the best pipe line economics and are spaced in an over-all pipe line length of 1179 miles. The exact geographical location, spacing, and compression ratios of the compressor stations are tabulated in Table 1.

enter the pipe line at the dehydration plant and the last station will receive approximately 262,000,000 cubic feet per 24 hours. The difference between delivered fuel and entered fuel is due to fuel consumed in operating the pipe line.

The seven stations, at present, are numbered evenly, 2-4-6-8, etc. This has been done in order that the ultimate design, which calls for interposing additional stations ahead of, and between, the present stations will result in consecutive numbering, 1-2-3-4-5, etc.

The purchase gas metering stations, the dehydration plant, and the seven compressor stations were designed and constructed by Stearns-Roger Manufacturing Company, and Parkhill & Wade were general consultants. In general, the design of the transmission line and compressor stations has followed lines intended to result in the utmost savings in material and labor consistent with safe and economical operation. A resume of some of the engineering details follows:

The seven compressor stations are

TABLE 1
Design Data—Compressor Stations
Initial Design

Station Number	LOCATION	Mi. Sta. to Sta.	H.P. Required	Installed H.P.	No. of Units	Pressure Absolute		Comp. Ratio
						Suction	Discharge*	
2	East Bernard, Texas	162.57	8,801	9,000	9	410	760	1.86
4	Jasper, Texas	157.40	8,696	9,000	9	416	759	1.86
6	West Monroe, Louisiana	160.10	8,592	9,000	9	416	772	1.86
8	Batesville, Mississippi	173.81	8,676	8,000	8	409	772	1.89
10	Lobelville, Tennessee	166.70	7,635	8,000	8	438	772	1.76
12	Campbellsville, Kentucky	178.63	8,234	8,000	8	416	769	1.85
14	Burnaugh, Kentucky	180.70	7,042	7,000	7	416	761	1.83
	Total	1179.91	57,726	58,000	58	....	....	....

* Pressure base—14.73 psi absolute.

The present design of the line calls for delivery of 207,000,000 cubic feet per 24 hours of natural gas to the last station. From the last station 150-165,000,000 feet per 24 hours will be delivered through a 20-inch pipe line to the Hope Natural Gas Company, Cornwell Station, and 35-45,000,000 cubic feet per 24 hours will be sent through a 12-inch pipe line to the United Fuel Gas Company, near Clendenin, West Virginia.

Ultimate Figures

The ultimate design contemplates that 293,500,000 cubic feet per 24 hours will not all alike in either horsepower or equipment, and as the flows of gas, cooling water, etc., are traced through the station, the equipment in various stations will be mentioned. Flow sheet of compressor station is given in Figure 1.

Piping Design

Engineers responsible for the design of the compressor plant piping have felt that the cross-country pipe line standards are inadequate for safe application to piping in such plants, even though the above section and division of the Code for Pressure Piping promulgated by American Standard Association permits carrying the cross-country piping standards into the compressor, provided such stations are outside of cities or villages or closely populated areas. Instead of following this section of the code, it was decided to follow the much more rigid standards of section 3 of the same code, using the standard set up in this section for oil and gas piping inside refinery limits. Extensive use of this latter section of the code over the past five or six years in the design of compressor plants, particularly for unusually high pressures ranging from 2500 to 4000 pounds, has indicated that the heavier wall thicknesses called for by this section are necessary in order to withstand additional stresses imposed by vibration in piping immediately surrounding the compressors themselves. This standard was accurately followed throughout the high pressure gas piping from the plant side of the inlet scrubber to the inlet flanges of the gas aftercoolers. A compromise standard roughly half way between the thicknesses called for under sections 2 and 3 was selected for piping beyond these points for a distance of roughly 150 yards each side of the compressor stations. This additional safety factor in piping close to the compressor stations is well justified on account of the concentrated risk to equipment and personnel.

Dust Scrubbers

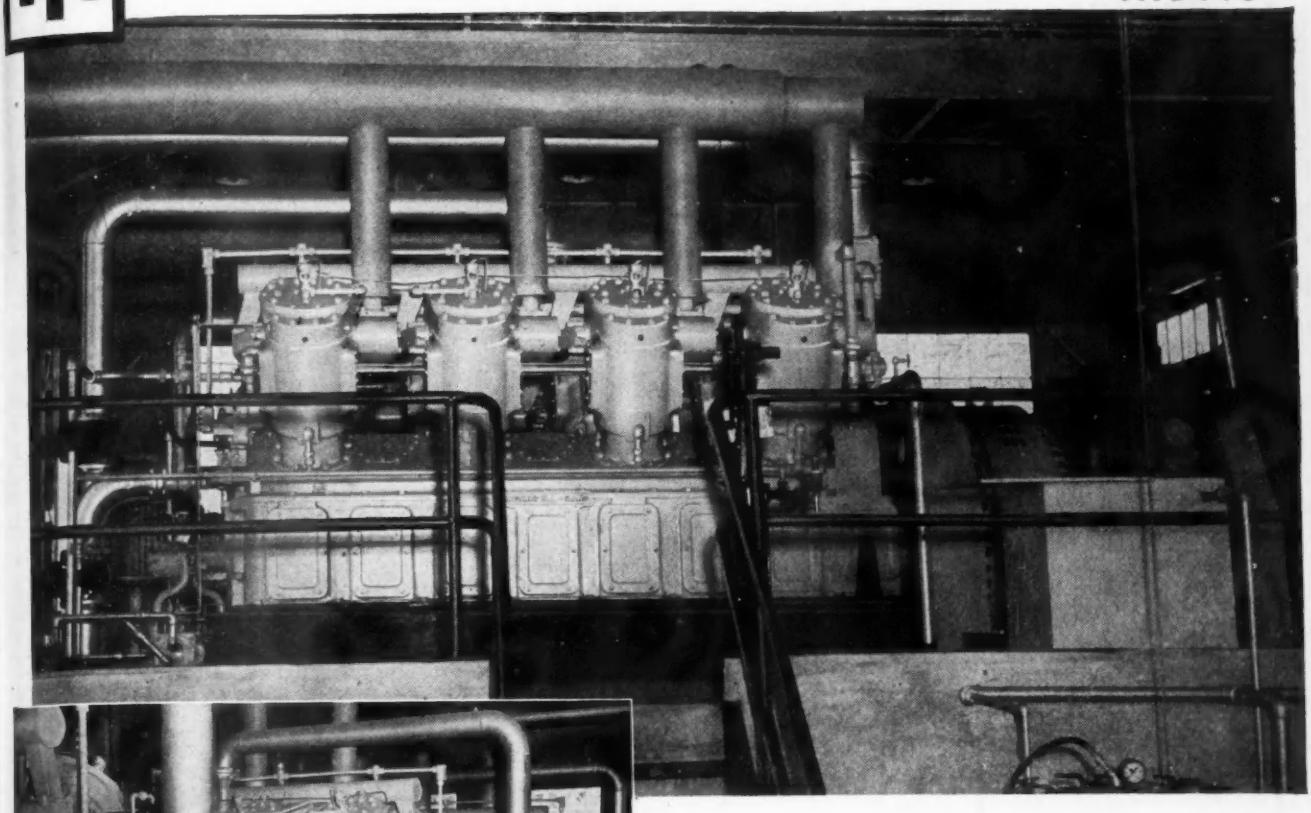
The inlet gas to the station is piped through 24-inch pipe to a battery of dust scrubbers. Three of these scrubbers are installed in all stations. At ultimate gas flow all stations, except No. 14, will require four. The exception on acount of the subtraction of fuel gas, requires only three. These scrubbers are 4½ feet in diameter and have a net shell length of 20 feet. Each vessel is designed according to the API-ASME code for pressure of 786 pounds per square inch gauge at a temperature of 100 degrees Fahrenheit.

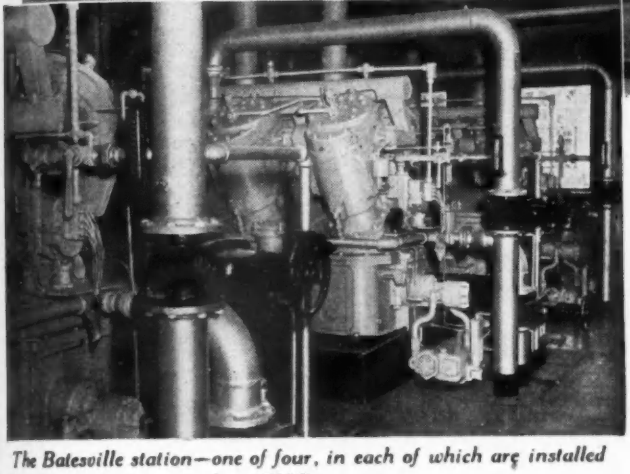
Each scrubber is designed to have a capacity of 75,000,000 cubic feet per 24 hours of gas. There is a 12-inch by-pass around these units to permit taking one unit off the line for cleaning.

The scrubber oil settling tanks and scrubber oil charging tank are mounted on steel framework. The dirty oil blown from the base of the scrubbers enters directly into either one of two 5 x 5-foot tanks, where the dirt is allowed to settle from the oil. The oil, after the dirt has settled, is drawn off through a swing

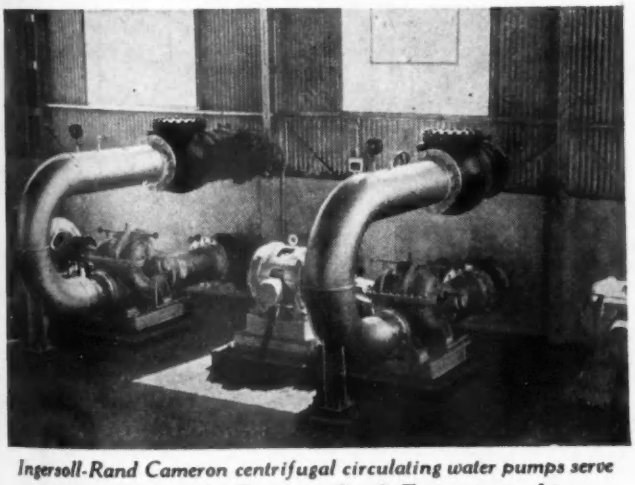
GAS ENGINE GENERATOR SETS

TYPE PVG





The Batesville station—one of four, in each of which are installed three PVG engines.



Ingersoll-Rand Cameron centrifugal circulating water pumps serve many stations on the Tennessee Gas & Transmission Line.

Serve the Tennessee Gas & Transmission Line

A number of the big stations of the great new line of the Tennessee Gas and Transmission Company are served by generators driven by Ingersoll-Rand 4-cycle Type PVG gas engines. Each installation has three 8-cylinder, 370 horsepower engines direct-connected to alternating current generators.

Gas engines of this type have established an enviable reputation in all divisions of the petroleum industry—pipelines, refineries, repressuring, recycling, and gasoline plants—driving generators, pumps, blowers, etc. Size 185 to 1200 BHP.

Ingersoll-Rand

11 Broadway, New York 4, N. Y. 6-560

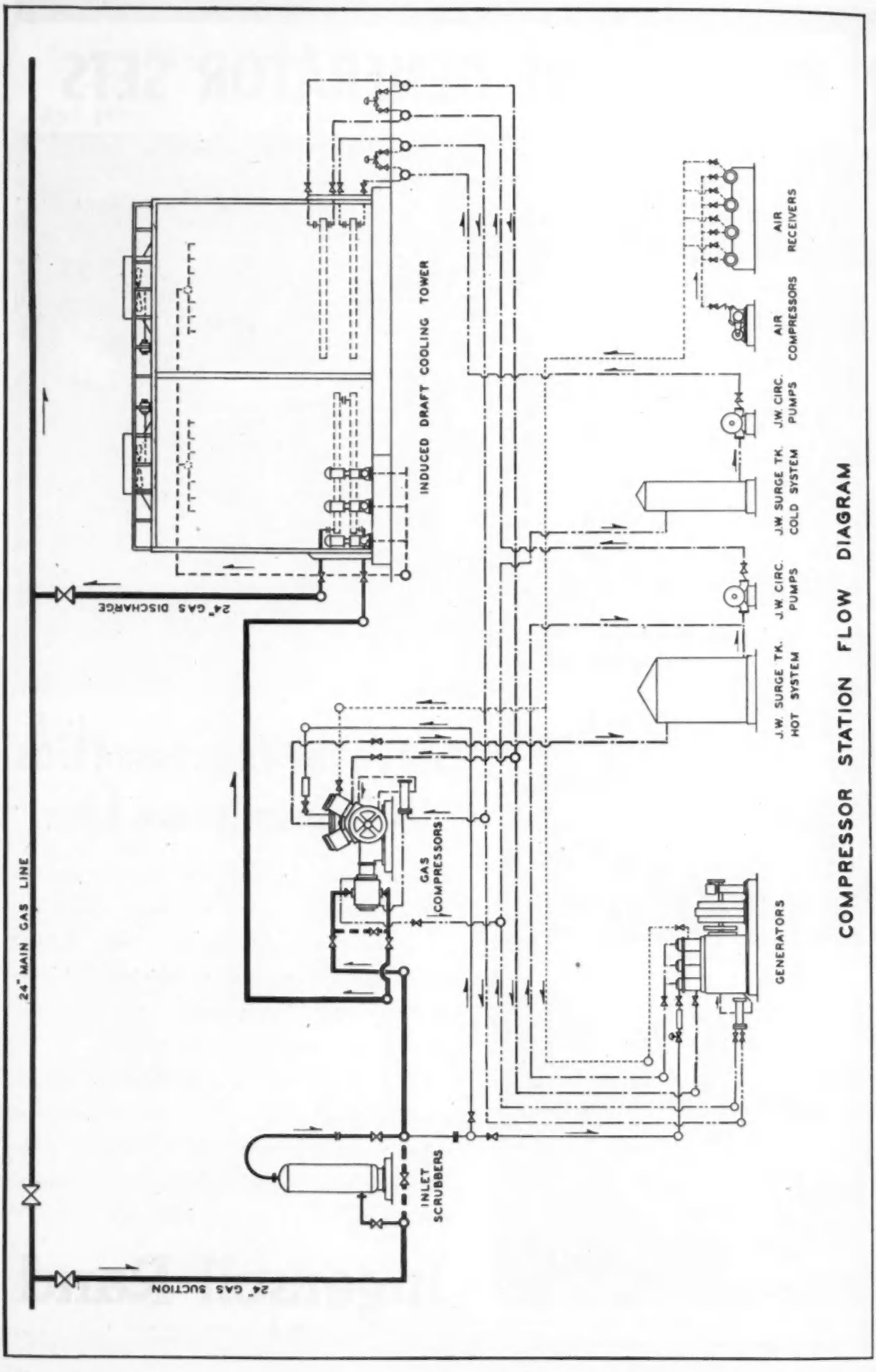


FIGURE 1

Schematic diagram of flow through idealized compressor station in which the arrangement of units and relative distances apart are not related to actual construction. The abbreviations in the lower portion of the diagram are, left to right: jacket water surge tank, hot system and the connected circulating pumps; then the jacket water surge tank for the cold system with pumps. These two systems relate respectively to the engine power cylinder jackets and to the compressor cylinders, to which latter are joined the oil heat exchanger flow quotas.

Schematic diagram of flow through ideanized compressor station in which the arrangement of units and relative distances apart are not related to actual construction. The abbreviations in the lower portion of the diagram are, left to right: jacket water surge tank, hot system and the connected circulating pumps; then the jacket water surge tank for the cold system with pumps. These two systems relate respectively to the engine power cylinder jackets and to the compressor cylinders, to which latter are joined the oil heat exchanger flow quotas.

suction line to the scrubber oil charging tank. A 3-inch line with shut-off valve is provided from the bottom of each tank. This is designed to drain the accumulated dirt and settlings to be placed into suitable containers for disposal, road surfacing, etc.

Vents, hatchways, etc., in these scrubber oil settling tanks are made weatherproof to prevent moisture from entering into the oil, carrying over to contaminate the dehydrated gas.

For filling the charging tank, a 14-gallons per minute herringbone gear type pump, with built-in safety valve, is provided. This pump is so manifolded that it takes suction from the lower half of either of the scrubber oil settling tanks and discharges into the filling tank.

The gas leaving each scrubber passes through a vertical section of 12-inch pipe that serves as a meter run. This run is connected to a recording flowmeter. There is no temperature recorder installed at these runs, as they are not check meters, but are installed only to permit evenly dividing the gas load to the scrubbers. An industrial thermometer in each run indicates temperature. These meters, however, may be used to give an approximate check on the amount of gas flowing into the station.

Selection of Compressors

On account of the lower weight per horsepower of the modern high speed angle type gas engine driven compressor units as compared with the slow speed horizontal types, the War Production Board required that the high speed machines should be used. This decision might have been made anyway without the interference of war conditions. Careful comparative estimates have indicated that the slow speed horizontal compressor units, which have been used conventionally in the past on pipe line service, cost from $5 to $10 more per horsepower on an installed basis than the high speed angle type units. In many cases up to the beginning of the war emergency the slow speed units have been preferred in spite of this difference in installed cost because operating data indicated lower maintenance cost. It is believed that this opinion was often based on insufficient experience with the angle type units, since such units were not used at all in pipe line service before about 1937. Further experience with the angle type units has given increasing evidence that the maintenance costs are little, if any, higher than for the slow speed units, and consequently, there is a tendency to prefer the high speed units for all types of service. This question cannot be finally settled until a good deal more experience with the high speed units has been accumulated.

Compressors

At each of Stations 2, 4, and 6 are presently installed 9—1000 horsepower in-line, angle type, gas engine driven gas compressors. These machines are placed end-to-end in a 30 x 304-foot steel frame, corrugated galvanized iron covered building, having a full ridge vent. These buildings have a bridge type traveling crane operating the full building length. Foundations for the compressors are made deep in order to provide a basement in the building. The compressor mat has been designed purposely to provide a very rigid and stiff base and generous soil bearing surface.

The compressor units are interconnected by means of a continuous walkway having steps down to the compressor room floor at alternate engines. Full basement ventilation has been provided and advantage has been taken of the basement windows to use them as safety escapes by providing access ladder rungs in the basement walls.

There are two uninsulated silencers per engine and each silencer exhaust line has a metal jacket which serves to carry heat radiated from the exhaust pipe to the outside of the building. A vent stack on this jacket is provided with a damper to enable the amount of hot air vented to be controlled. This materially reduces the building heating load in cold weather.

Air cleaners have been provided and installed on an 18-inch air intake line to all compressors. These units are provided with 16-inch backfire relief valves to prevent damage in case of backfire.

At each of Stations 8, 10, and 12 are installed 8—1000 horsepower V-angle type, gas engine driven gas compressors. These engines are placed in a single row side by side with crankshafts perpendicular to the axis of the buildings.

In Station 14 are installed 7 of the same units. Full provision is made in Stations 8, 10, 12, and 14 for 9 ultimate engines. In Station 8 the mat and blocks have been poured and the building sized for 9 engines. Station 14 has 8 blocks and suitable building.

These engines are provided with only one silencer apiece. Air cooled exhaust jacket arrangements are similar to those

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DEEP-ROCK
MOTOR OILS

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TULSA, OKLAHOMA

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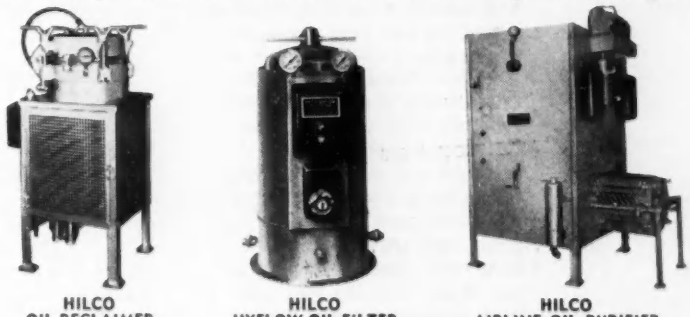
They Serve All Main and Auxiliary Gas Engines On
TENNESSEE GAS & TRANSMISSION PIPE LINE
For Complete and Continuous Lubricating Oil Purifying



HILCO OIL RECLAIMER
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Headquarters for
LUBRICATING AND FUEL OIL PURIFIERS
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THE HILLIARD CORPORATION
25 W. FOURTH STREET ELMIRA, NEW YORK

in other stations. The same air cleaners and backfire relief valves are used.

The gas is, at present, compressed from a suction pressure of approximately 401 to 750 pounds through each compressor in Stations 2-4-6-8-10-12. In the ultimate stations, the gas will be compressed from approximately 485 to 750 pounds. In this case, the compression ratio will be less and the compression heating will be reduced. Compression ratios per station are shown in Figure 1.

Compressor units in Stations 2, 4, and 6 are provided with three compressor cylinders 8¼ inches in diameter with a stroke of 15 inches. The compressor units in Stations 8, 10, and 12 have four cylinders 7½ inches in diameter with 14-inch stroke. All cylinders are provided with built-in clearance pockets to provide necessary clearance for present and ultimate design.

Station 14 has been specially designed for future flexibility. Six of the seven installed engines have one cylinder 8¼ inches in diameter with 14-inch stroke, while the other four cylinders on these units are 7 inches in diameter with 14-inch stroke. The larger cylinders are to handle from 35,000,000 to 45,000,000 cubic feet per 24 hours of gas from an inlet pressure of approximately 400 pounds to a discharge pressure of 475 pounds for delivery to one of the sales outlets. The small cylinders handle from 150,000,000 to 165,000,000 cubic feet per 24 hours from the same inlet pressure with a discharge pressure up to 760 pounds for delivery to another sales outlet. The two discharge pressures are required in order to fill contractual obligations for fuel gas. The high pressure gas from Station 14 is delivered through a 20-inch line a distance of 82 miles to Hope Natural Gas Company, Cornwell Station, and the low pressure gas is delivered 7 miles through a 12-inch line to United Fuel Company at Clendenin, West Virginia.

All cylinders in this station are equipped with unloaders, valve lifters, and built-in clearance pockets in order to adequately cover the pressure range requirements.

The gas is discharged from each compressor through a 10-inch branch line which is saddled from an expansion bend into a 24-inch discharge header.

The buildings housing the engines in Stations 10, 12, and 14 are 36 x 202 x 20 feet, and 36 x 228 x 20 feet in Station 8. In these stations, the compressor foundations are also deep and a full basement is provided. Full basement ventilation is also provided as in Stations 2, 4, and 6.

Stairways afford access to the basement at either end of all compressor buildings, and a central escape hatch to the compressor floor midway in the buildings afford an additional emergency exit from the basement.

Advantage is taken of the basement to house a jacket water dump tank, the oil reclaimer units, dirty and clean oil tanks, and drainage sump pumps. The jacket water dump tank serves as a container to collect jacket water drained from the engines when down for repair. Such a tank is necessary to avoid waste of expensive treated water on a closed system. The tanks are connected to enable the operator to blow, by means of air, the drained water back into the main surge tanks. These tanks are protected from overpressure.

Compressor Ignition

Engine ignition is the direct-current-impulse type with individual induction coils for each spark-plug. Engines of one manufacture are provided with one distributor handling 10 cylinders. The other engines have dual ignition systems for 8 cylinders. Instead of the conventional magneto source of power to the ignition coils, there is provided an individual direct current rectifier of the copper oxide type for each engine. These units are supplied from a 440-volt, 3-phase, 60-cycle source, having their own built-in transformers, and provide a practically rippleless 10-14 volt, 2 to 4 amp. direct current which will supply the ignition demands of all engines. Each unit has its own volt and ampere meter, built-in circuit breaker, and rheostat for varying the voltage as required. There are no batteries in the ignition circuit.

This system of ignition was developed for the first time for this project and has been thoroughly tested under actual operating conditions by the engine manufacturers. It provides an exceptionally clean and trouble-free source of direct current.

One distinct advantage of this system is that it provides a fool-proof inter-lock between the station electric generators, water circulating pumps and engines. If the electric power fails for any reason, the water circulating pumps on the jacket water system being electric-driven, necessarily shut down. Since the compressor ignition system will also shut

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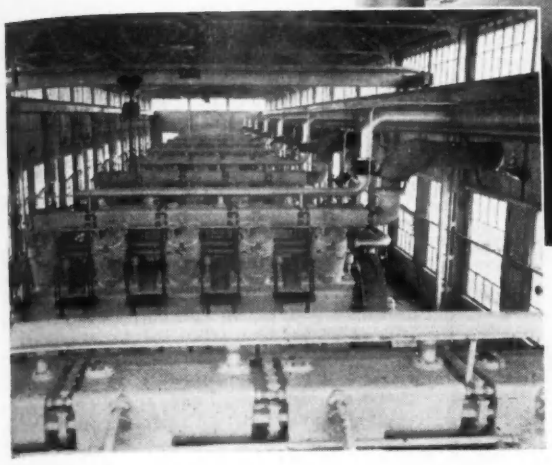
Unit of the Tennessee Gas and Transmission Company pipe line



Pipe line conceived and built by Tennessee Gas and Transmission Co.; Dehydration plant, seven compressor stations and two check meter stations, designed, engineered and constructed by Stearns-Roger Mfg. Co. Prefabricated piping, pipe bends, and pipe clamps for Dehydration Plant, four compressor stations and both check meter stations and hand rails, scrubber oil tanks, etc., by Houston Pipe and Steel, Inc.

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down upon a power failure, the compressors are stopped at once, making it impossible for them to become overheated by running after failure of the jacket water circulation.

Another advantage lies in the fact that each machine has its own individual rectifier unit and is, thus, independent of all the other machines. Thus the entire station cannot be shut down through failure of an element of the ignition supply, which is always a possibility where a central battery-and-charger system is used.

Finally, the system is actually cheaper to install and much cheaper to maintain than either the individual magnetos or a central battery-and-charger.

Oil System

Two oil reclaimer units are installed in the basement at each station. These units are so arranged that the oil from any engine may be treated and returned to that engine.

An oil drain header is installed in the basement and connected to the compressor rod packing gland housings. This header is also connected through valves to the crankcase of each engine. The compressor rod oil drips enter this line and flow to a dirty oil tank; also, when an engine is taken off the line for maintenance, the oil may be drained to the dirty oil tank. The oil reclaimer units receive oil from the dirty oil tank and deliver the reclaimed oil to the clean oil tank. A manually operated dispenser pump is placed on the compressor floor, and takes suction from the clean oil tank.

Two additional lube oil dispenser units with counters are installed in each compressor building. These pumps are directly connected to the fresh oil supply, which is stored in horizontal 10 x 20-foot main lube oil storage tank installed near the building.

There is a drain pan in the compressor floor directly connecting into the dirty oil tank, and another connecting into the clean or reclaimed oil tank. In case polluted oil must be disposed of, it may be poured down into the dirty oil tank, and clean oil may be returned to the reclaimed or clean oil tank through these drain pans. This lubrication system provides for flexibility in handling lube oil and with a minimum of waste.

Gas Cooling

The 24-inch gas discharge header runs to the cooling tower, where the gas enters into atmospheric cooling sections. These sections have been selected to obtain a low pressure drop, both at present and in the ultimate design. They are provided with 8-inch inlet and outlet nozzles and each bank is individually valved. The sections are connected in parallel banks of two sections each, in series, with an upward flow. In all stations, except No. 14, 800-pound single-pass sections are used. In case of Station 14, 1000-pound single-pass sections are used as this station is designed to operate at a higher ultimate pressure.

The main gas inlet header and each lead to and from the coils is provided with an industrial thermometer. The gas flows from the cooling sections into a 24-inch outlet header and thence directly to the main pipe line.

Cooling Towers

The cooling towers are the induced draft type and are all identical.

The spray water requirements for Stations 2, 4, and 6 are 8000 gallons per

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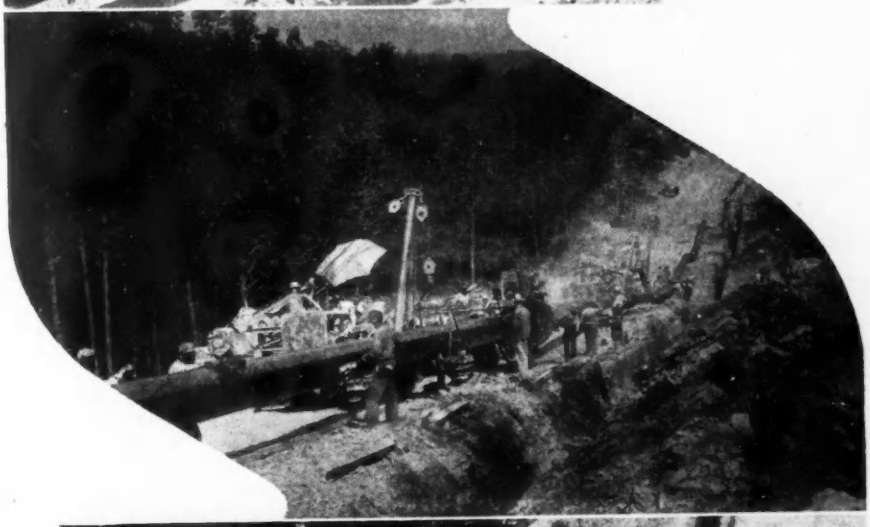

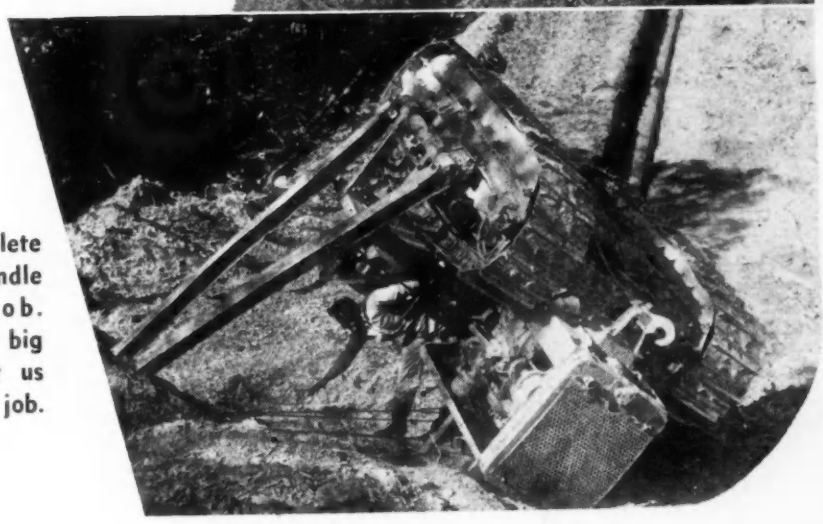

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minute each; for Stations 8, 10, and 12, 8960 gallons per minute each; and for Station 14, 9450 gallons per minute. The design temperature of basin water for towers 2, 4, 6, and 14 is 93 degrees Fahrenheit, and for towers 8, 10, and 12, 92 degrees Fahrenheit. The water is cooled to 80 degrees in these towers with 75 degrees Fahrenheit atmospheric wet-bulb, except No. 14, which cools the water to 81 with 75 degrees wet-bulb.

Three pumps have been installed per tower for recirculating the spray water. They are vertical, single stage, turbine type pumps, electric motor driven. In Stations 2, 4, and 6, each of these pumps handles 4000 gallons per minute; in Stations 8, 10, and 12, 4500 gallons per minute each; and in Station 14, 4750 gallons per minute each.

The pumps are mounted at one end of the tower, over a sump which communicates through double screens with the basin proper. Each pump discharges through an 18-inch check and gate valve into a 24-inch header line. Water is taken over the tower through three 16-inch lines. Each of these lines has orifice flanges and plate installed in order that the water may be metered.

Cooling water is made up to the tower through a 4-inch line. After much discussion, makeup water valves were discarded and 4-inch meter runs were installed. An indicating flowmeter is installed to control the water flow to the tower. This provides an accurate method of maintaining control over makeup and assures a constant wastage, thus controlling the basin concentration of salts.

Cooling Water System

In selecting the proper cooling system, the principle objective was to attain a cooling system which would permit of not more than 10 degrees Fahrenheit temperature rise through the power cylinder jackets, and with a minimum power consumption. All manufacturers contacted agreed that a 10-degree Fahrenheit rise through the jackets of the engines was very desirable for best engine performance.

The system chosen and installed calls for two separate cooling water systems:

The "hot" circulating circuit circulates water through compressor engine cylinder jackets and electric generator engine cylinder jackets in parallel, and thence, through cooling sections mounted in the cooling tower. The entering water is at 140 degrees Fahrenheit and the temperature rise is 10 degrees Fahrenheit. The water is circulated at Stations 2, 4, and 6 by means of 2 electric motor driven, horizontal, single-stage, centrifugal pumps, having a capacity each of 3600 gallons per minute of water. A 10 x 20-foot vertical surge tank is provided on the suction of the pumps. Two units are required for normal operation, and a third unit is provided for a spare.

Since Stations 8, 10, 12, and 14 have been calculated to handle a total future installation of 9 engines, the same size of cooling water pumps have been installed as in the other stations.

As two of these units run continuously, no emergency control has been provided on these pumps. If one pump should shut down, the second pump would maintain sufficient circulation to prevent damage until the spare pump could be started, or the compressors and generators shut down. A pressure switch is installed on the pump discharge which sounds a warning signal on low pressure or pressure failure, to warn the operator.

The pumps force the jacket water through a 24-inch header to the cooling tower, where it flows upward through six parallel banks of 2 atmospheric cooling sections in all stations, except No. 14, which has 5. These coils have 8-inch inlet and outlet nozzles, and require a 6-pound pressure drop. Industrial thermometer wells are installed in each inlet and outlet line.

To control the cooling water temperature, a temperature-controlled bypass valve is connected across the inlet and outlet water headers. The outlet water temperature from the engines is controlled.

In the secondary or "cold" circulating circuit, the water passes through the oil coolers and the compressor cylinders in series. The water from the compressor cylinders flows to a 4-foot diameter x 20-foot high surge and vent tank connected in the circuit and merges with the water from the generator oil coolers at the suction of the recirculating pumps. The pumps discharge the water through a 14-foot header to the cooling tower, and through six parallel cooling banks each consisting of two sections in series at Stations 2, 4, 6, and 14, and seven parallel cooling banks each consisting of two sections in Stations 8, 10, and 12.

Water circulation in the "cold" circuit is maintained at Stations 2, 4, and 6 by use of an electric motor-driven, horizontal, double suction, single stage, centrifugal pump, having a capacity of 1335 gallons per minute. At Stations 8, 10, 12, and 14 this pump is rated 1850 gallons per minte. Spares are provided for all pumps.

In this system, one pump runs continuously, and one pump acts as spare. No automatic starting system for the spare pump has been installed, since a failure of cooling in this system will do no damage. To control the temperature in this "cold" circuit, a temperature-controlled bypass valve is connected across the inlet and outlet headers to the cooling sections.

All water in the cooling systems is treated for corrosion control and to reduce scale forming tendencies. The cooling tower basin and piping alone contain approximately 175,000 gallons of water; the "hot" circuit contains about 45,000 gallons of water, and the "cold" circuit about 15,000 gallons. Before initial operation of these systems, each was given an initial treatment to obtain the best possible cooling water. It is planned to make daily checks on all water to insure complete water control, which control will be directly reflected in reduced maintenance costs and increased pumping capacities through maintaining high heat transfer coefficients.

Electric Power System

Electric power for each compressor station is generated by three gas engine driven generators. In Stations 2, 4, and 6, the 4-cycle gas engine drives are rated 400 horsepower at 450 revolutions per minute, and in Stations 8, 10, 12, and 14 the units are rated 370 horsepower at 400 revolutions per minute.

The generators of all units are of the standard open frame engine type, rated 312 Kva, 250-kilowatt, 480-volt, 3-phase, 60 cycles, with a 40-degree Centigrade rise. The generators are equipped with 7½-kilowatt, 125-volt, 1750 revolutions per minute, V-belt connected exciters.

Each engine has the exhaust muffled by a silencer; intake air is cleaned by an air cleaner, with backfire relief valve.

Generators feed electric energy directly to a buss system contained in a unitized totally enclosed control center. From the center, electric power is distributed to all parts of the station.

Breakers are provided for engine ignition rectifiers, sump pumps, heater motors, circulating water pumps, air compressors, elevated water tower pumps, cooling tower fans and recirculating water pumps, well pumps and plant lights. Spare circuits are pro-

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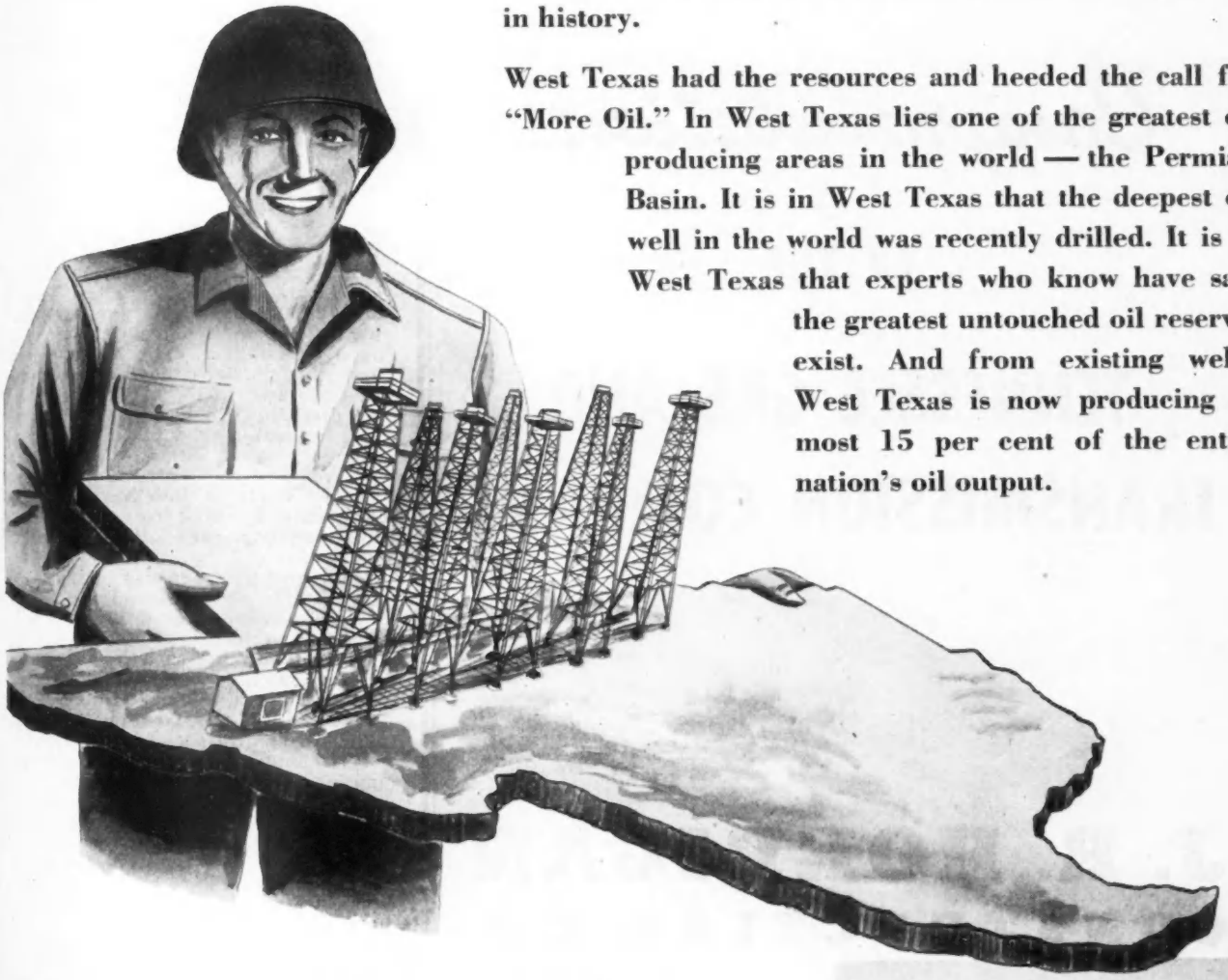

Electric power plays a vitally important part in every phase of the oil industry—well pumping, pipe line pumping, refining and well drilling. And electric power from the lines of Texas Electric Service Company had a lot to do with the speed and efficiency with which West Texas was able to heed the call for "More Oil."

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vided, as well as a power factor meter, indicating watt meter and totalizing and indicating kilowatt hour meter.

Generator units are housed with the cooling system pumps and starting air compressors in a steel frame, galvanized iron covered buildings, 40 wide by 78 feet in length. A full bridge type craneway is provided for convenience in overhauling generators and pumps. The pumps are located in a 3-foot pit at one end of the building and are reached by stairs.

In all stations the starting air units consist of 1—electric driven air compressor and 1—combination electric motor and gasoline engine drive air compressor. All air compressors have a 40 cubic foot air per minute capacity so that each station has a total capacity of 80 cubic feet per minute. These compressors discharge into four air receivers 30 inches by 15 feet, designed to operate at 250 pounds. The air tanks have pressure gauges and relief valves.

A small oil reclaimer unit is installed in each generator building, and operates on the three engines. A dirty oil tank is provided to allow crankcase oil from any engine to be drained. The reclaimer unit takes oil from this tank, cleans it, and discharges it into a clean or reclaimed oil tank, provided with a dispenser pump. Oil makeup can be from this tank or from another dispenser pump connected to the 10 x 20-foot main lube oil storage tank.

In Stations 2, 4, 6, and 8 two water wells supplying 200 gallons per minute each have been drilled. Electric motor drive deep well pumps have been installed in these wells. These wells discharge through a check valve into the 2000-barrel main water storage tank. Stations 10, 12, and 14 have supply sources from nearby streams and springs. Station 10 has a 10,000-barrel main reservoir tank, and Station 12 has two earthen reservoirs. These reservoirs, springs, and streams supply water to the 2000-barrel water storage tank.

The feed water to the 2000-barrel tank is controlled by a level controller with float ball in the tank, operating a 4-inch throttling type diaphragm valve on the feed line. The cooling tower basin water is furnished directly from this tank through a 4-inch line.

Stations 2, 4, and 6 each has an elevated tower tank 40 feet high, to supply pressure on the station and camp water systems. Water is supplied to this tank by means of two 80 gallons per minute electrically-driven centrifugal pumps, taking suction directly from the 2000-barrel tank. These pumps are controlled by a hydrostatically operated electric relay which operates when the tower water level reaches a predetermined low point, and shuts off when a high level has been reached. Either one or both pumps may be used, as required. Stations 8, 10, 12, and 14 each has a standpipe 60 feet high of 24-inch pipe serving as water storage tank. Water is supplied to these by small electric motor centrifugal pumps.

The fuel gas to each station enters a pilot-operated primary fuel gas regulator where the pressure is reduced from 400 to 200 pounds. This regulator opens upon pilot failure. The 200-pound gas from this regulator enters a secondary pilot-operated fuel gas regulator where the pressure is reduced to 100 pounds. This regulator is duplicated by regulator in parallel; either will handle the fuel requirements for the compressor station. Each of these regulators will close upon its pilot failure; while the other regulator then takes the full load of the plant.

The primary regulator is spaced a considerable distance from the secondary fuel gas regulator in order to minimize the refrigerating effect of the gas expansion through each regulator.

Gas from the secondary fuel gas regulator enters a volume chamber where the flow of gas is smoothed out. The regulator control pressure line taps into this volume chamber, the reserve volume of gas preventing regulator "hunting." A 6-inch pipeline from this volume chamber acts as an orifice meter run. The fuel gas requirement for the station is metered through this run by means of a standard orifice meter. A recording thermometer is also installed in this run.

The gas leaving the metering run enters into a second volume chamber on the outlet of which is placed a balanced pressure regulating valve. The pressure is reduced from 100 pounds to the compressor fuel requirements by this regulator, and at the required pressure the gas is then supplied through a 10-inch fuel gas header to the compressor building, and through a 4-inch line to the generator building.

The generator fuel gas regulator is a sensitive type regulator which drops the pressure from 45 pounds to 1 pound into a small volume tank which is protected from overpressure through a diaphragm control valve acting as a relief valve. The gas from the regulator volume chamber then enters the 6-inch generator fuel header. Each generator is

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equipped with a sensitive regulator, reducing pressure from 1 pound to 3 inches of water. A volume tank is provided between the generator regulator and mixing valve.

The compressors do not have individual regulators, but a large main fuel header is installed and each compressor is provided with a large fuel volume chamber to smooth out surges and provide additional volume.

The primary regulator is installed in a valve box in the plant yard and the secondary and intermediate regulators, volume chambers, and 6-inch meter run, are housed in a separate steel frame, corrugated, galvanized iron building. The generator fuel regulators are housed in the auxiliary building. The secondary fuel, intermediate pressure, and generator fuel regulators are all duplicated as a precaution against shutdowns.

The gas fuel to the office building, pipeline warehouse, machine shop, and change room building is measured through a displacement meter, and the pressure is reduced at each building by regulators handling the required fuel. These regulating valves have built-in relief valves and automatic shutoff features.

Speed Control

Since Stations 12 and 14 are subject to fluctuating demand, automatic speed control has been installed in these stations. These automatic controls maintain the station pressure as required. The control center of these systems is a 2-pen pressure recorder-controller. One pen records station suction pressure; the second, or controller pen, is actuated from the discharge gas header pressure and controls air supply to a diaphragm motor with positioner for resetting the engine governor spring. A second diaphragm lever motor with positioner controls the scavenging air bypass and is in turn controlled by the gas manifold pressure. In action the automatic control acts to change the governed speed of the engine, and the amount of scavenged air is changed in proportion. Station 14 controller has an additional pen which records discharge pressure on low pressure system.

In Stations 2, 4, 6, 8, 10, a 2-pen pressure recorder is installed in the compressor room and connected to record station gas discharge and suction pressure. These instruments may be changed later, if desired, to pressure controllers for automatic speed control service by inserting the pressure control elements in the instrument cases.

Provision is made at all stations for heating the warehouse, shop and change room building and pipeline warehouse by means of individual gas-fired heater units. The offices at Stations 8, 10, 12, and 14 are heated by gas-fired forced air furnaces. The offices at Stations 2, 4, and 6 are heated by individual room type heaters. The compressor building and auxiliary building at Stations 10, 12, and 14 are heated by means of 15-pound steam. The steam is generated in a gas-fired boiler located in the auxiliary building. Steam is piped to the compressor building through an underground conduit and thence to individual heating units.

The remainder of the buildings at these stations are not heated and on account of their geographical location, no provision is made for heat at Sta-

• CONTINUED ON PAGE 166

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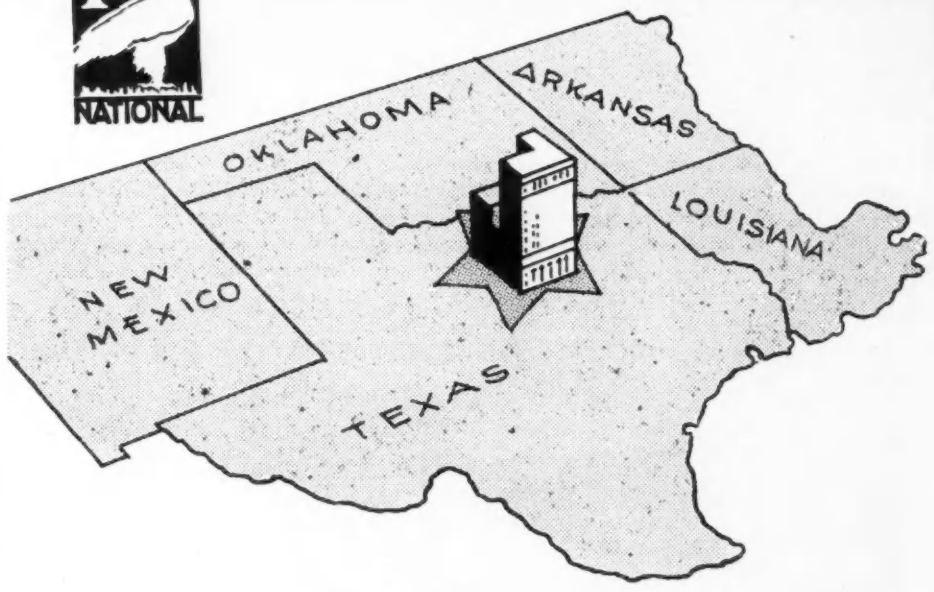

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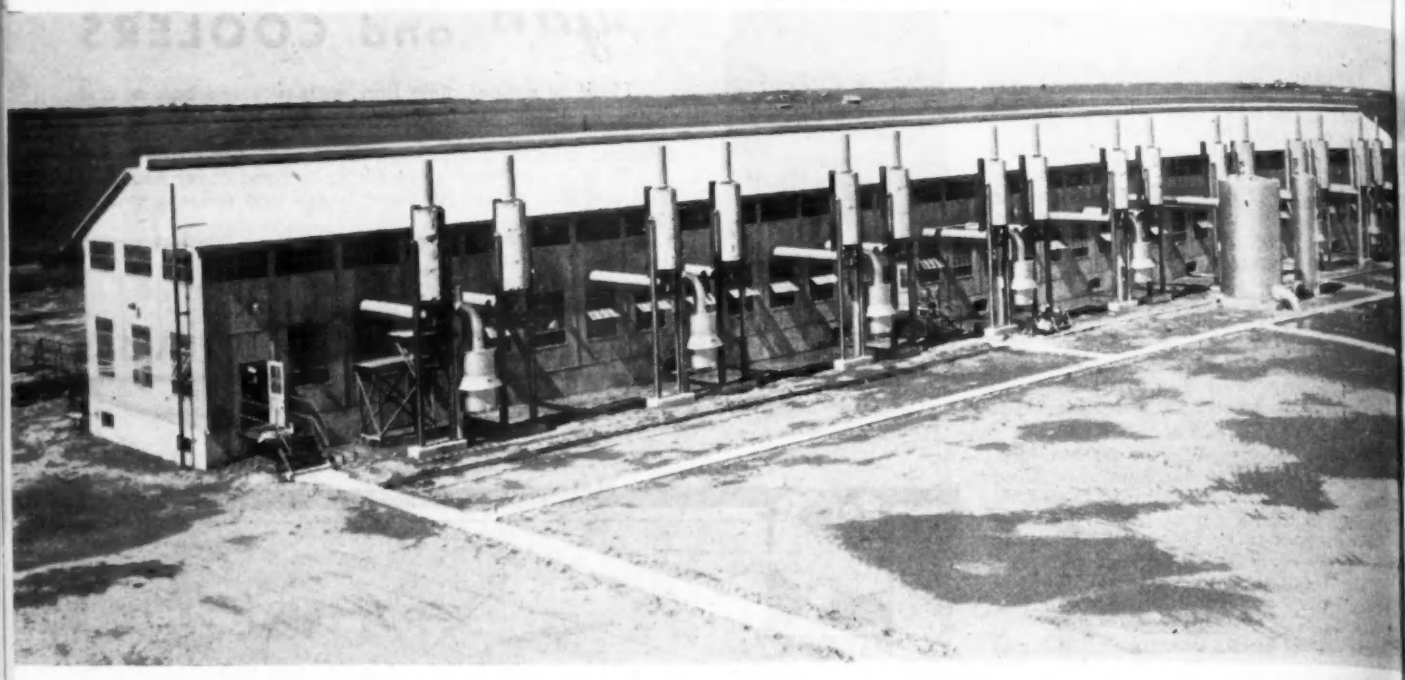
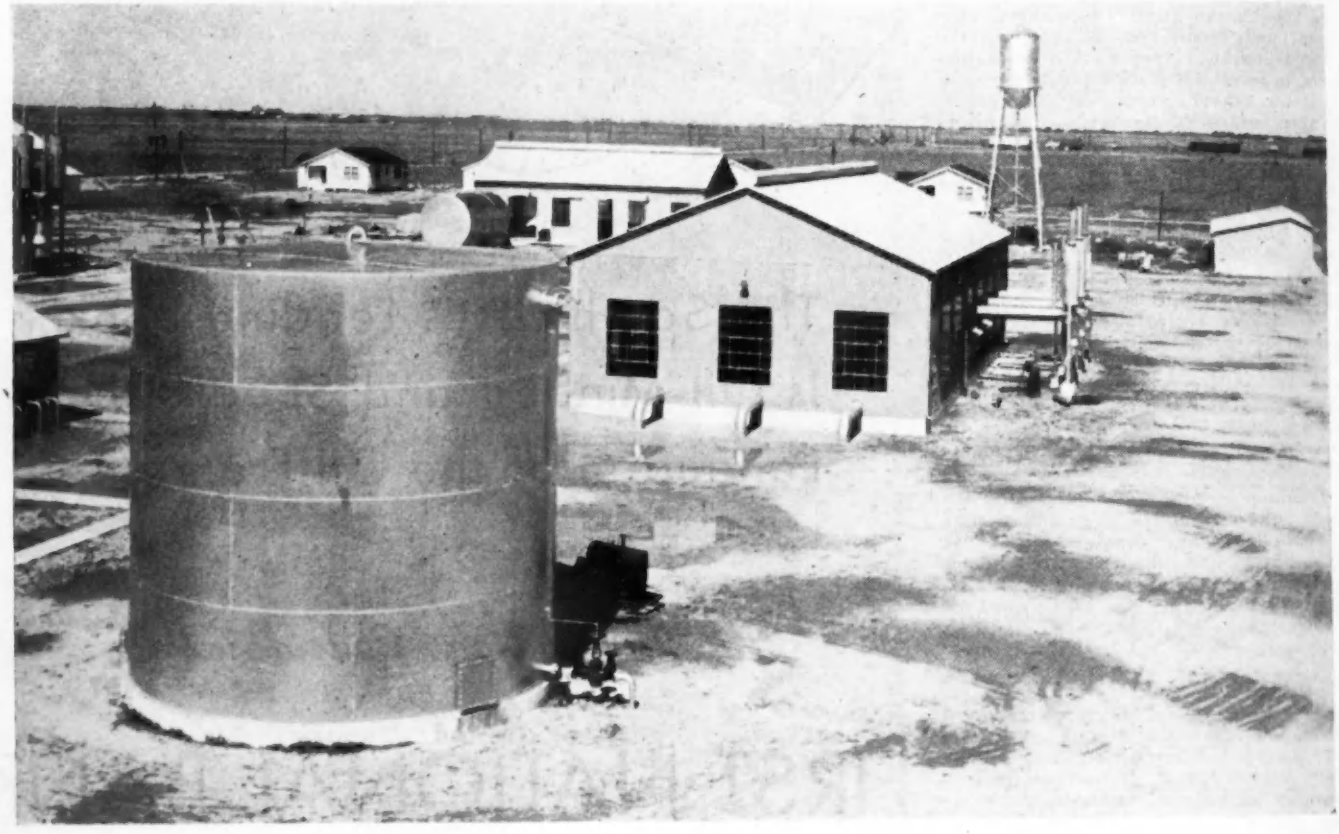


First of the series of stations as at present constructed, this one at East Bernard, Texas, is supplied by gas still under residual well pressure, although 170 miles from the dehydration plant. The compressors are housed in a 304-foot building with continuous ventilator, dual window arrangement giving light at floor working level and above the crane rails. The engines in this station are each equipped with single air cleaner and dual mufflers, and the jacket-water system surge tanks are set up with the "hot" circuit tank to the left, the "cold" circuit to the right as the building is viewed from the office.



Other buildings on a typical station yard include the power plant, a maintenance shop, a meter room, an office building, with especialy insulated rooms for housing the calorimeter and gravitometer, and houses for four of the operating personnel. The 2,000-barrel tank in the foreground is for raw water storage, to provide make-up for cooling tower and jacket-water system, while the elevated tank beyond the power plant building affords the required head for maintaining household and fire-protection systems.

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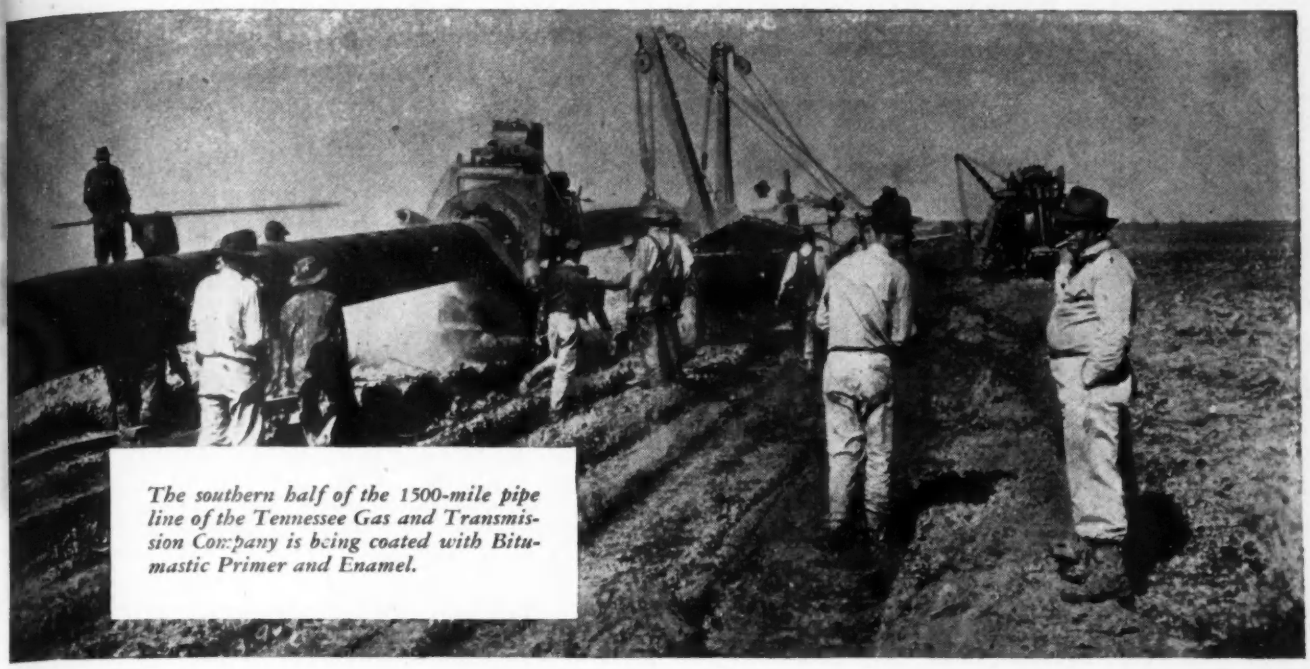

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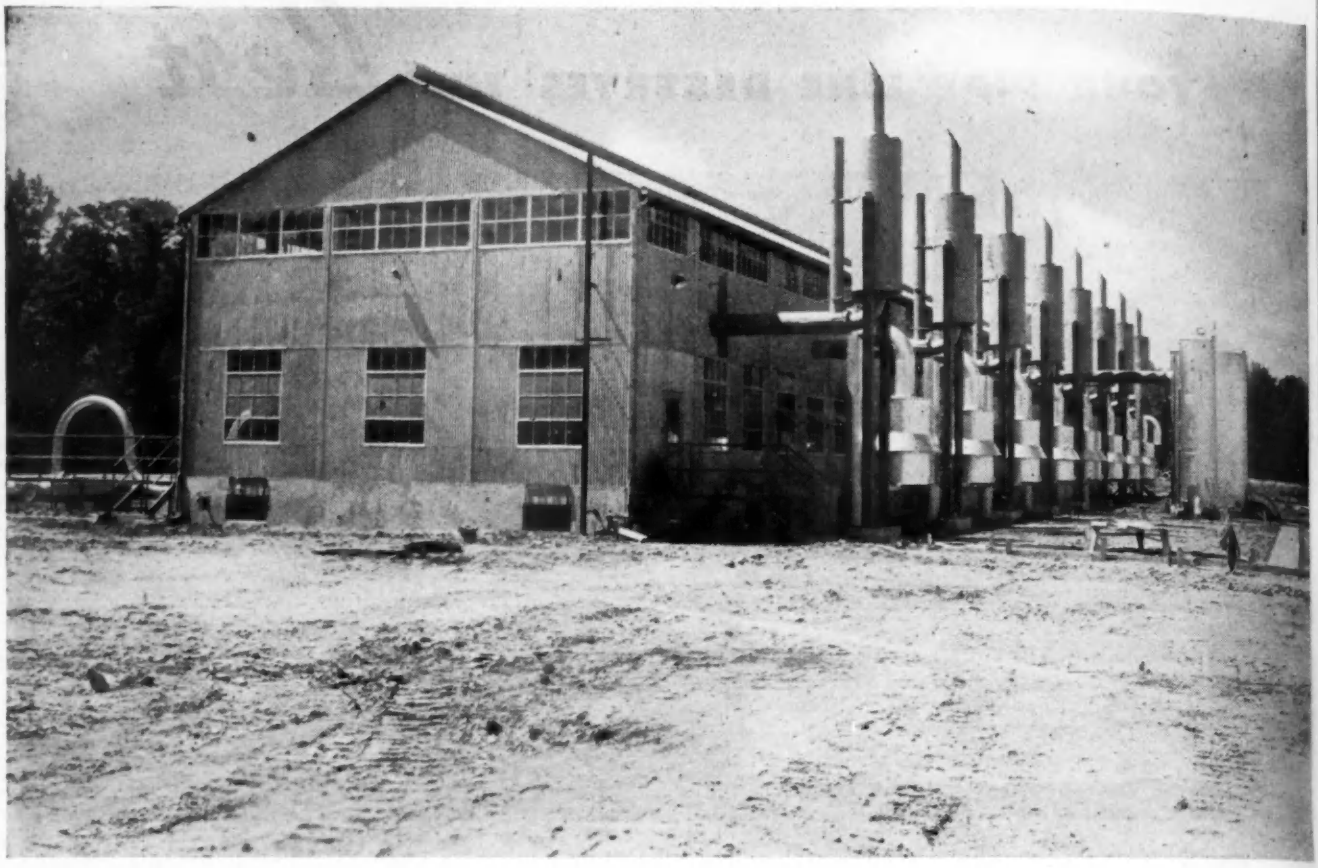

Typical of the stations on the upper end of the line, this one at Batesville, Mississippi, shows the single muffler per engine set-up adopted, with the outer or ventilating shell surrounding the exhaust pipe. The auxiliary stack behind the muffler is provided with a damper so the heat normally vented in this manner may be retained and the exhaust pipe heat utilized in reducing the heating load of the compressor building during cold weather. The arrangement of the two cooling systems in these stations is reversed from that lower down the line, as is eviednced by the relative positions of the two surge tanks to the right of the line of mufflers.

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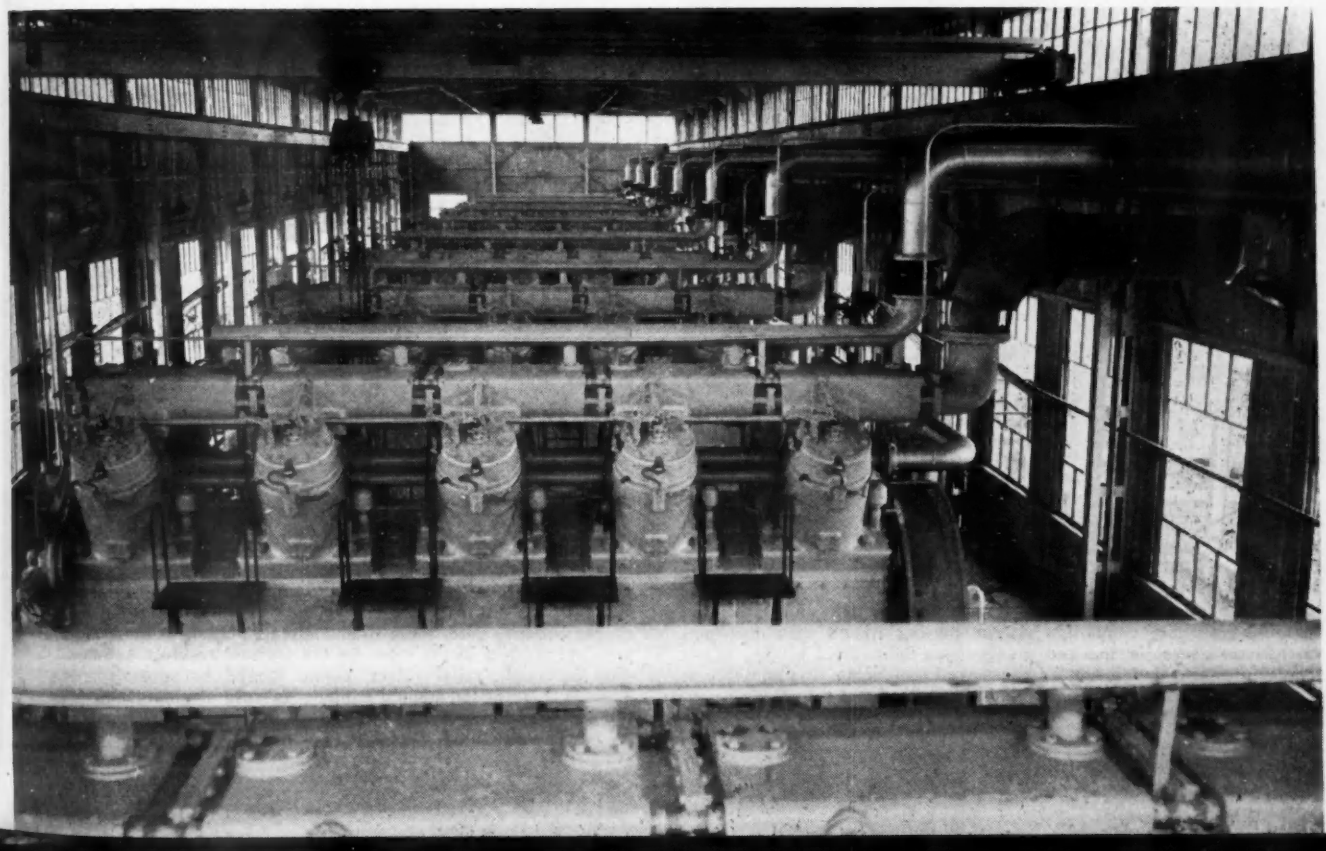
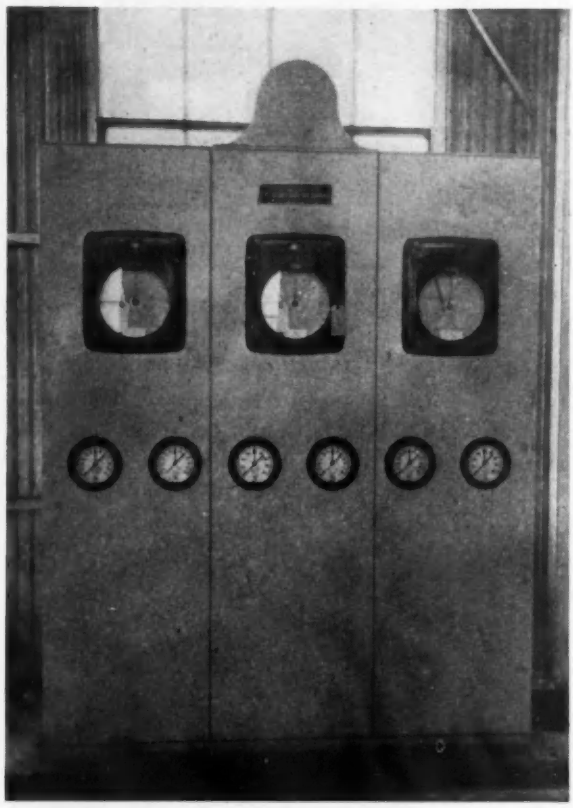
TULSA, OKLAHOMA

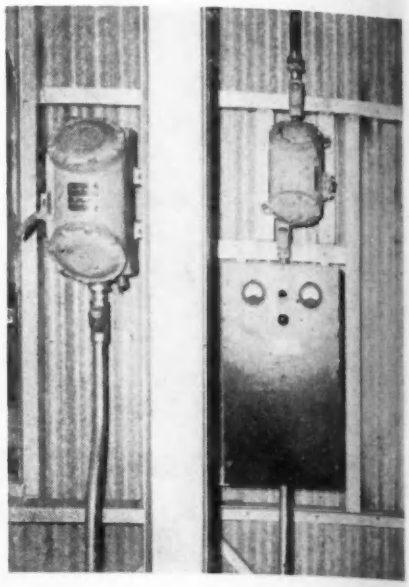


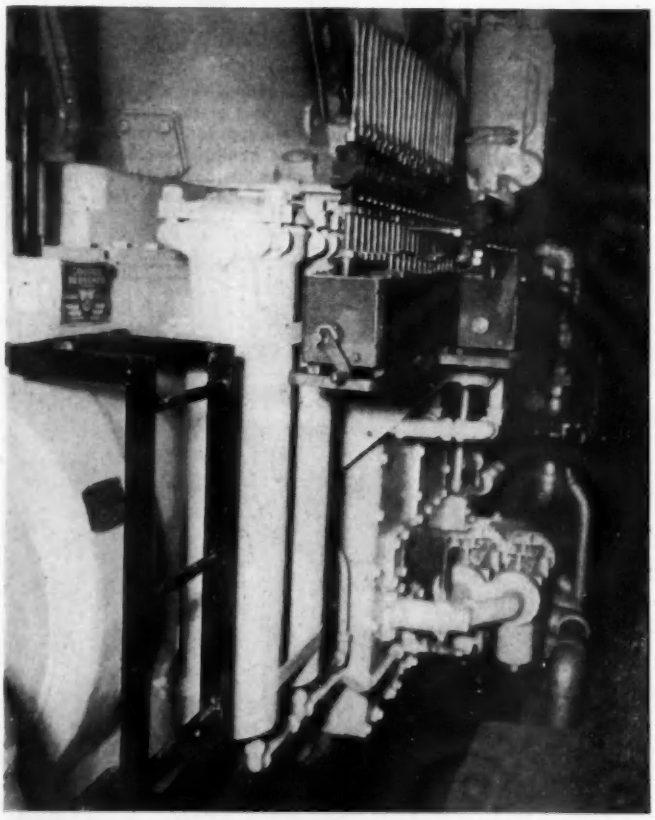
Two types of angle compressers are used in equipping the line, the first four stations being of one design, the remaining three of another. The upper photograph shows the 9 units in Station 2, at East Bernard, Texas, while the lower view is typical of the upper part of the line, being taken in the Lobelsville station, number 10. The long narrow building housing these units, as contrasted with the area needed for former compressor stations, lends itself to the use of a relatively short span overhead crane, permits grouping of lighting units in three banks, one along each wall and one under the ridge-pole of the roof, and at the same time may insure ample illumination for efficient operation. Although the engines are arranged in series in one station and parallel in another, the exhaust piping, air intake, and both gas and circulating water mains follow similar arrangements in all the compressor building layouts.



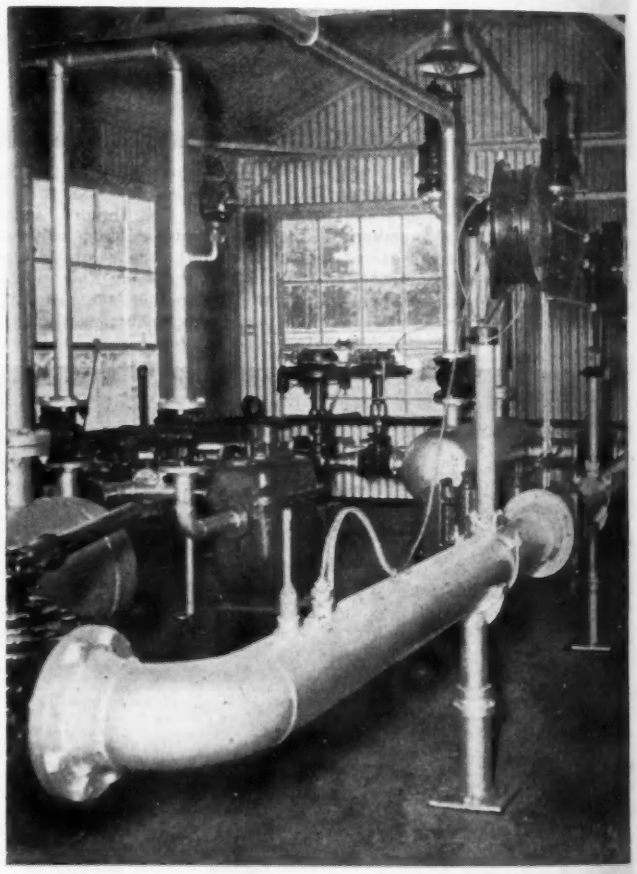
The station panel (left) is the same on all stations, with recorders to show pressures of suction and discharge gas lines, fuel pressures to the engines, and the pressures on the two cooling systems caring for the engine cylinders at one range of temperatures and the compressor cylinders and oil cooling at another. The panel is located midway of the 100-yard long building.

Seeing its first application as source of primary ignition current in these stations is the use of a rectifier (right) on the power circuit of the station, serving to lower line voltage and at the same time transform it from A.C. to D.C. to give the desired current for the ignition circuits of the 1,000-horsepower compressor engines. The master switch above the unit is explosion, gas and moisture proof.





One of the many devices introduced in the stations to eliminate the human element as far as possible is this oil filter unit which takes oil from the crankcase circulation system, purifies it and then maintains the lubricant level in the two plunger-type lubricators serving power and compressor cylinders and all bearings of the engine. The unit returns excess to the oil sump, and eliminates hand filling.



Gas used by the compressor and auxiliary engines is drawn from the incoming stream, metered and regulated down to the desired intake pressures, in this compact metering room. Set into the run—behind the nearer of the two recording instrument stands—is an orifice meter which checks quantity used, while volume meters determine the flow in various units. At the rear of the room are the pressure regulators, flanked by the dual automatic relief valves, spring loaded but provided with hand lever for manual tripping, in case of emergency.

ILLUSTRATING ONLY A FEW OF HUNDREDS OF FISHER CONTROLLERS ON THE TENNESSEE GAS & TRANSMISSION CO. PIPE LINE

Fisher fuel gas control regulators on generator engines at a Mississippi station.

Fisher "Giant" type pressure and flow control valves on the collecting system at recycling plant.

all along the Line

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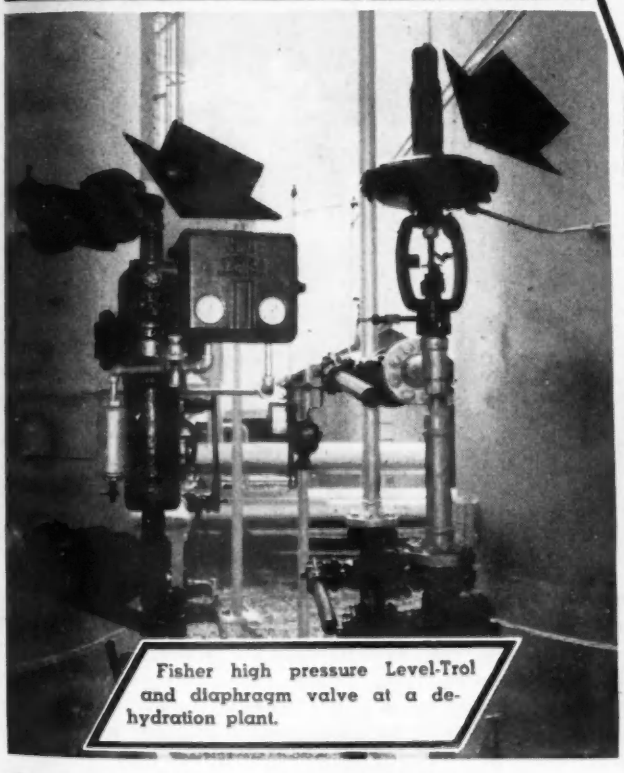
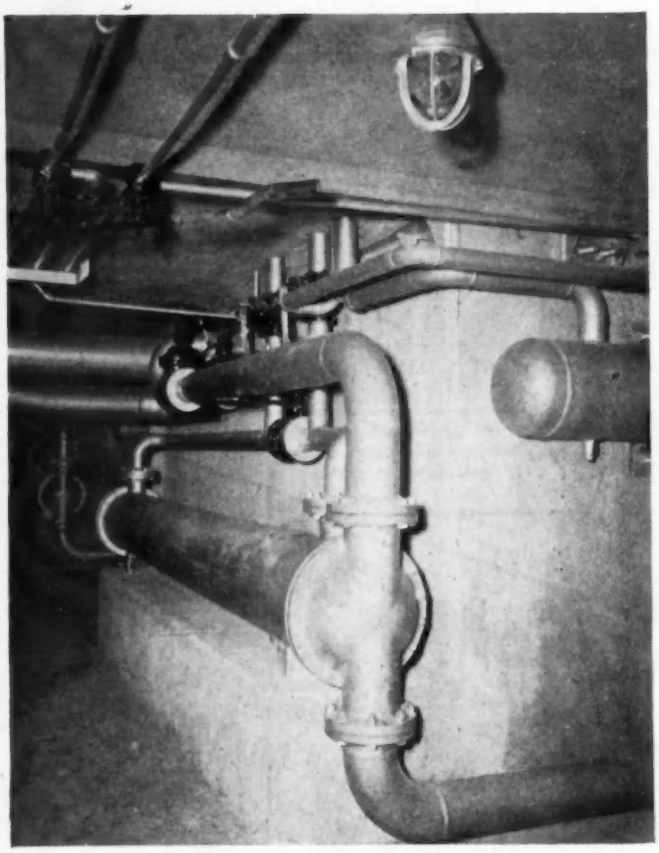
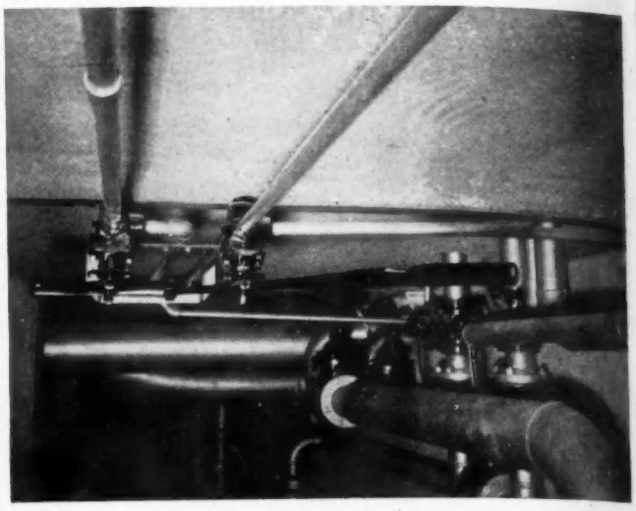


Fisher high pressure Level-Trol and diaphragm valve at a dehydration plant.

Fisher primary fuel gas regulators — Wizard Pilot operated at one of the many pumping stations.

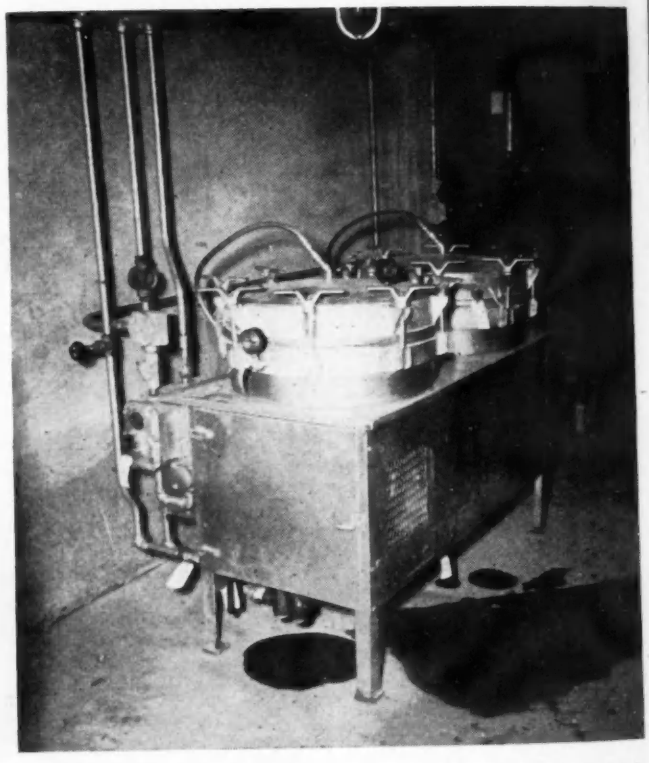


Oil from one of the compressor units is circulated through this heat exchanger (left) in which any desired temperature may be established by varying rate of coolant flow. The unit is provided with bypass to prevent stoppage while the unit is being serviced, or it may be removed and replaced with a new unit in case of fouling by simply unbolting the connection flanges on oil and water flow lines.



The lines which carry the oil from any engine to and from the reconditioning units, mounted at the ends of the station "basements," are run parallel, with the three-way valves tying in to the oil circulation systems of an engine in such a way that throwing the handle connecting the two valves insures clean flow of oil from the purifier into the engine as foul oil is being withdrawn from the sump.

Oil drawn from the engine sumps is pumped to a rectangular settling tank, where heavier particles are given opportunity to settle out, and any entrained water to collect, before the fluid to be reclaimed is passed on to the purifying unit. These tanks are provided with manhole covers which normally are oil and pressure tight, but which may be removed to permit manual cleaning of the sumps in the settling basin.



Motor driven purifying machines are so arranged that they draw supply from the mid-zone of the settling tanks and thoroughly remove all flocculent matter, grit, emulsion and other impurities which are not trapped in the settling tank. The unit returns the reclaimed oil to the circulation or supply system of the station, in quantity equaling that drawn off from any engine base at the same time.

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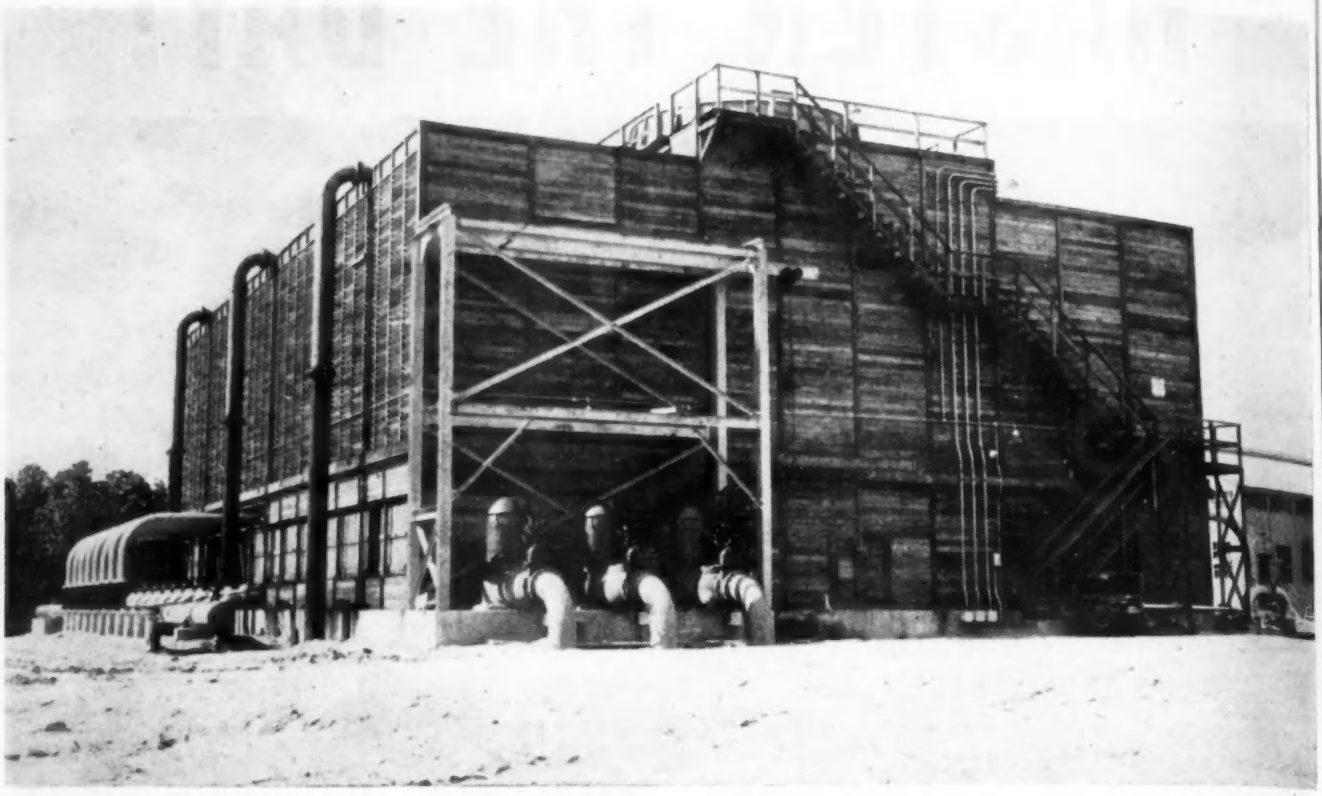
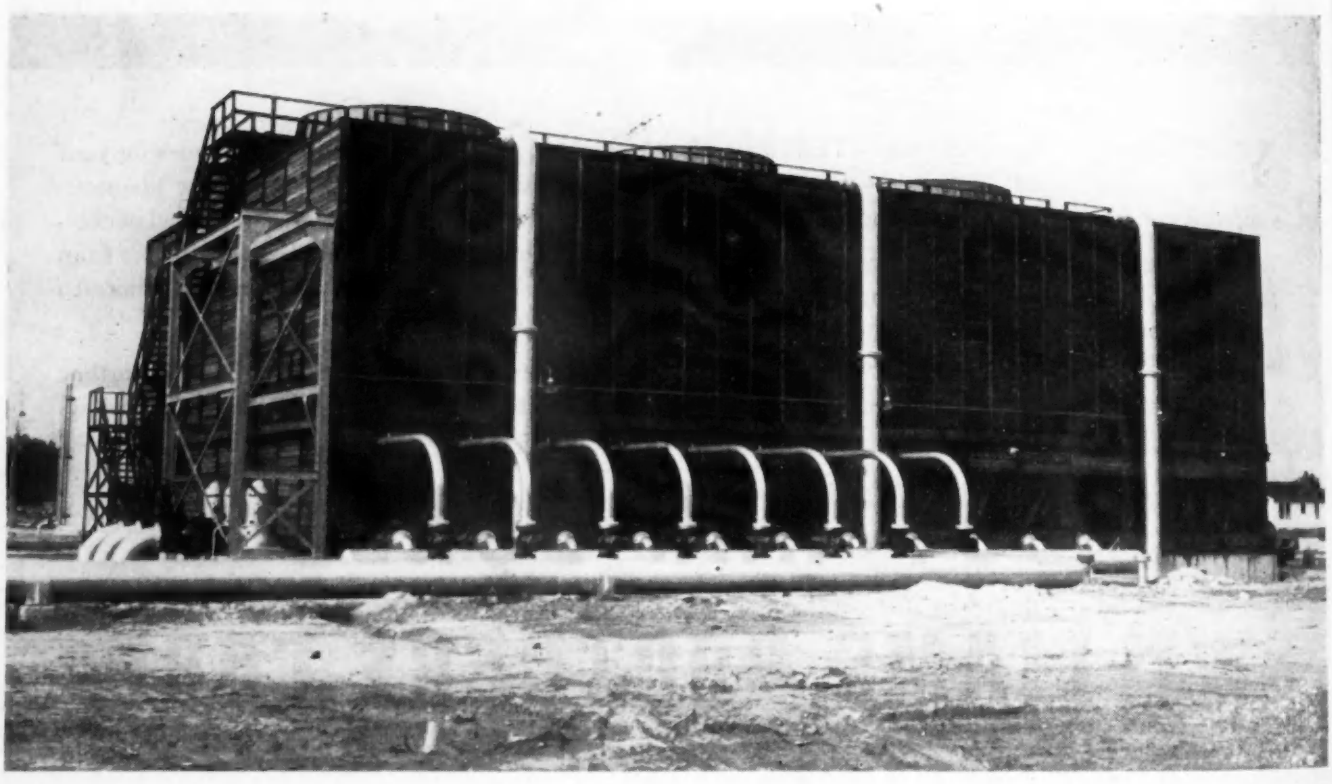
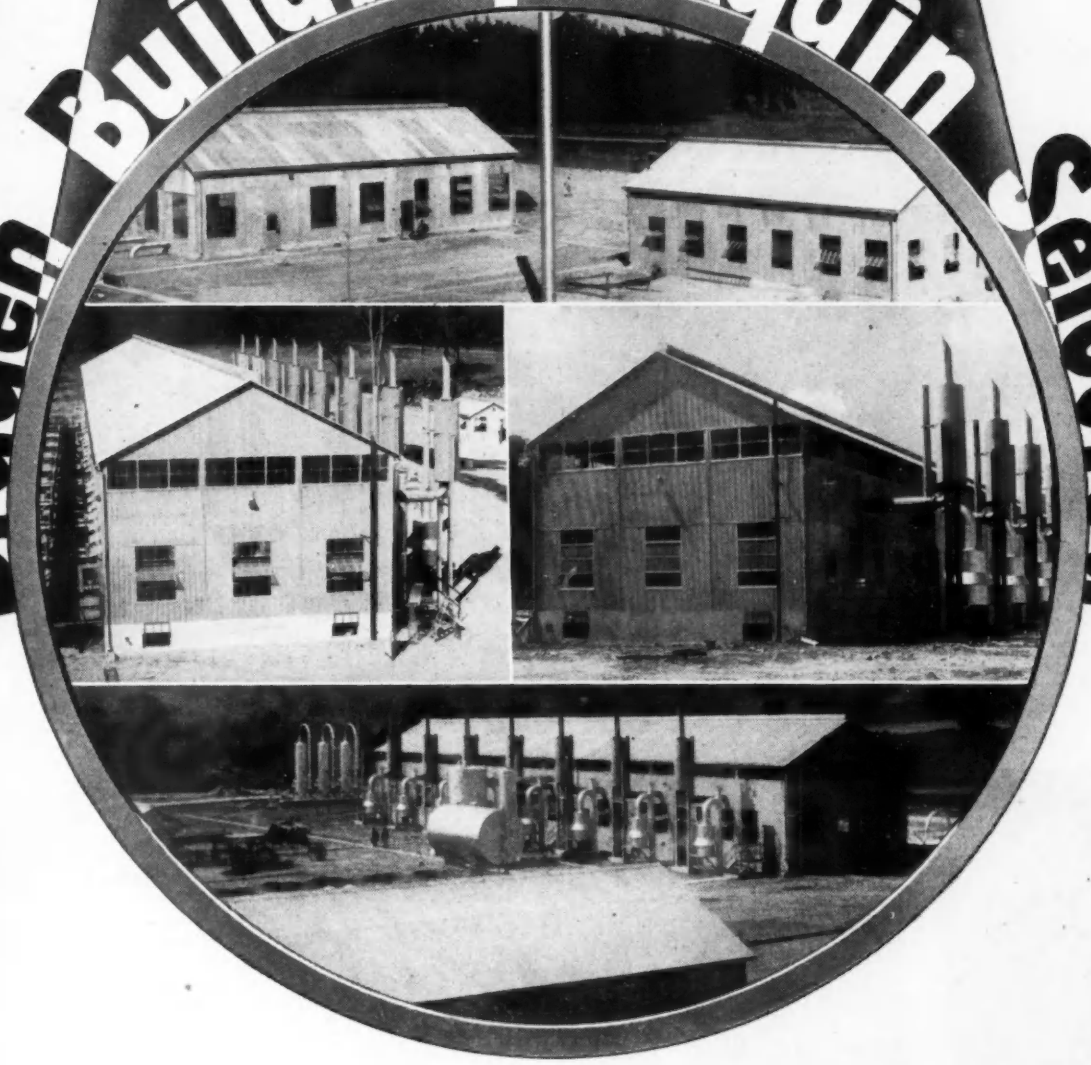


Cooling towers on the line come in rights or lefts, depending on station sites, direction of prevailing winds, and piping layouts for minimum runs and direct flow. In this view the West Monroe (Station 6) tower brings in its gas from the left, with the cooling water pumps, sumps and delivery lines so arranged as to give straight-line connection on that end. The power leads for the fans and lighting circuits are carried up the tower behind the stairway giving access to the upper deck. A steel frame provides hoist support for pump servicing.



This station (No. 8 at Batesville, Miss.) might be termed right-handed, since the gas connections are at the right when viewing the unit from the compressor building. Again the circulating water pumps are near the gas headers, with structural steel hoist support flanking the tower. The three fan housings of the unit are visible over the top, between the cooling water inlet lines. The fans are individually driven, and equipped with the air-foil type blades of stainless steel. Drive motors are mounted on upper deck.

Braden Buildings Again Selected



We consider it a compliment to Braden engineering and fabrication, to again have been selected to furnish a majority of the sectional steel buildings on one of the country's major pipe line projects.

Complete installations of Braden Sectional Steel Buildings were made by the Tennessee Gas & Transmission Company at their Batesville, Miss., Lobeville, Tenn., Campbellsville, Ky., and Burnaugh, Ky., stations.

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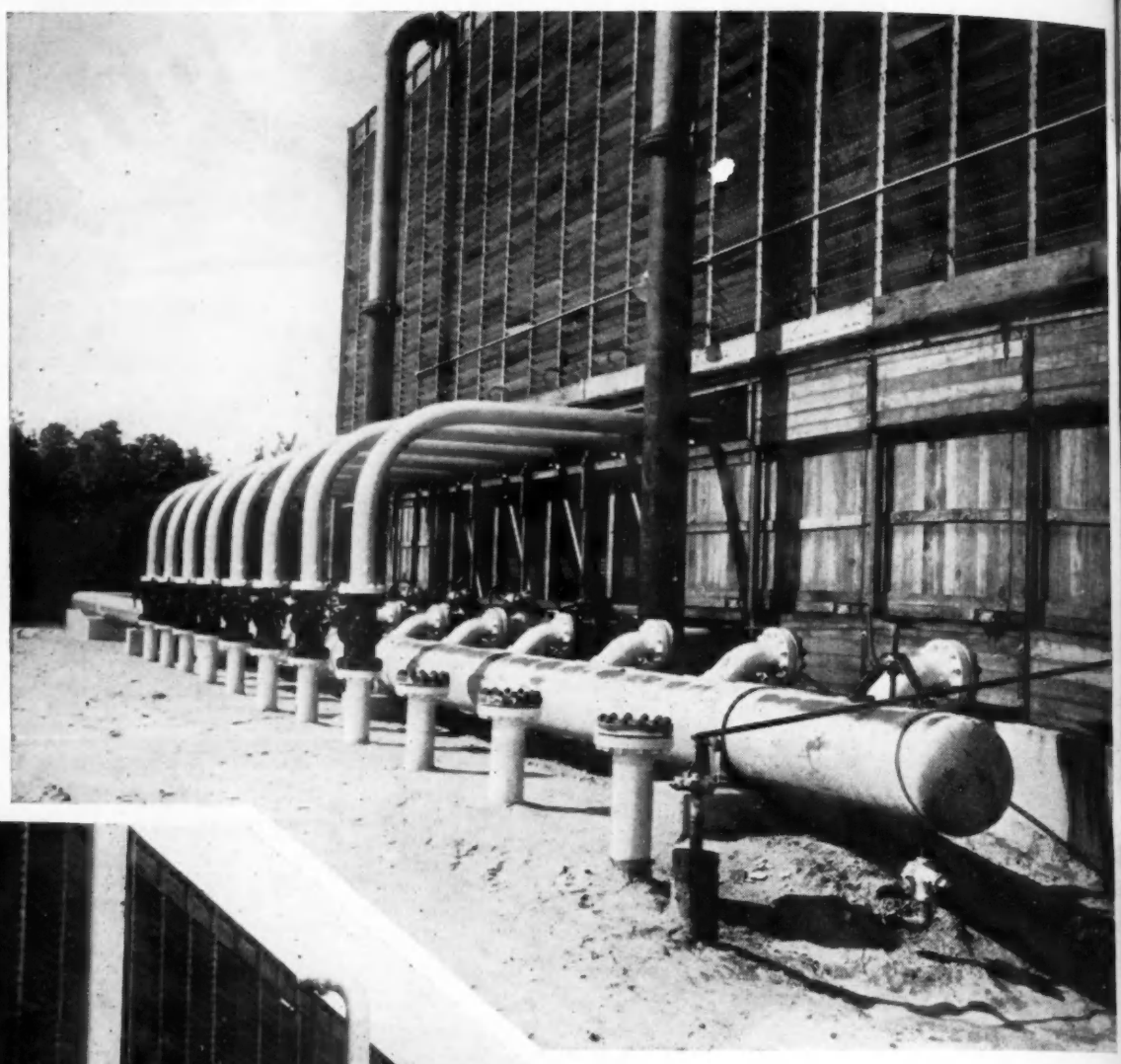
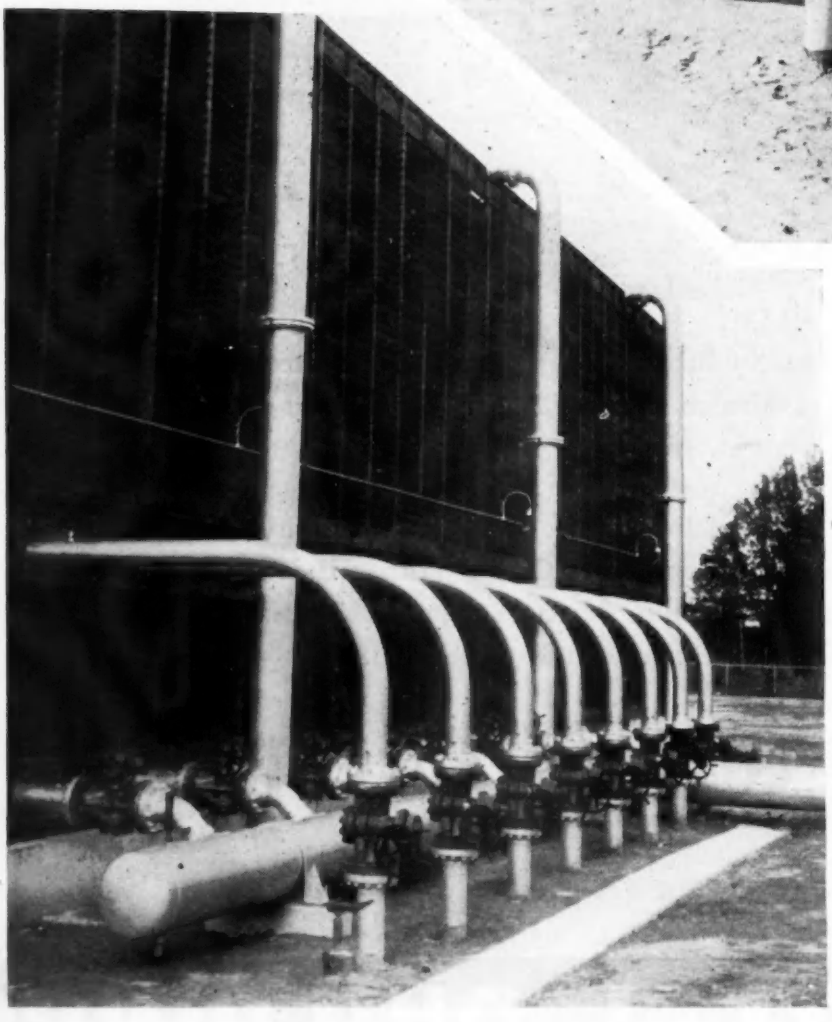


A left-handed gas header on the West Monroe, Louisiana, station tower is shown above. The header above ground brings in the gas from the compressors, the flanged lines nearer the tower leading the gas to the bottom banks of the heat exchangers, from which the flow is upward to the delivery sweep ells, leading through the block valves to the risers on the buried outgoing gas line. Stub lines are for added throughput.



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At Batesville, Miss., (left) the gas from the compressors comes in at right angles to the tower, branching both ways to make connection with the heat-exchanger lines. On this tower, as on others providing for additional capacity, the blank sections are to the right of the ones now corrected. A separate slighting circuit, with low set reflectors above the control valves, aids in making nighttime changes.

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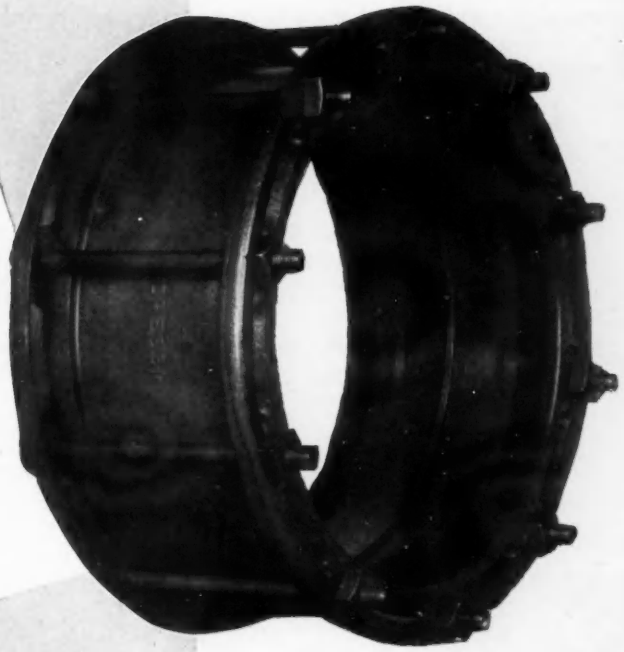

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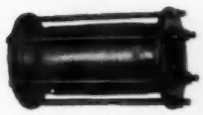

DRESSER STYLE 40
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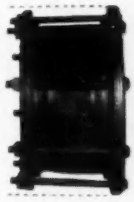

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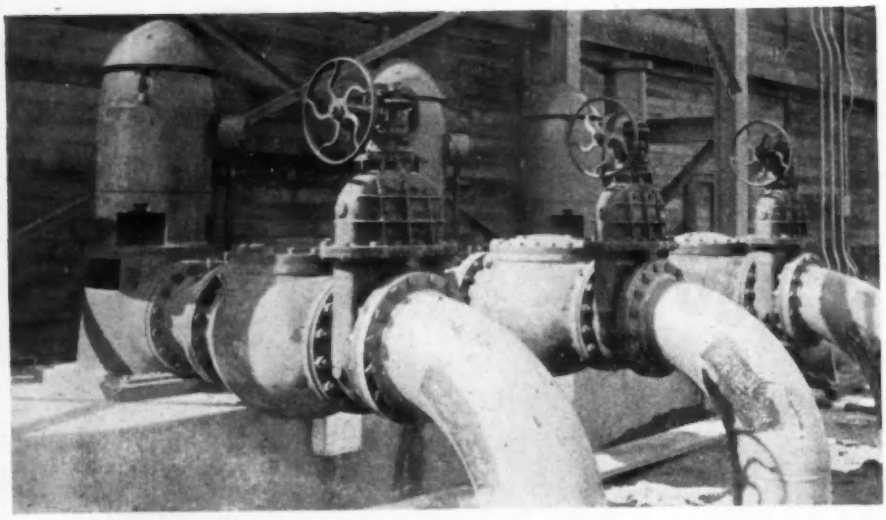

The division of the line into two units, each separately equipped by individual contracts, brings two or more manufacturers of similar equipment into the picture. At top left, one type of direct-connected cooling water pumps is shown connected to the checks and valves which will control the flow of 8,000 gallons of water per minute over the deck. This view was taken during construction of the tower.

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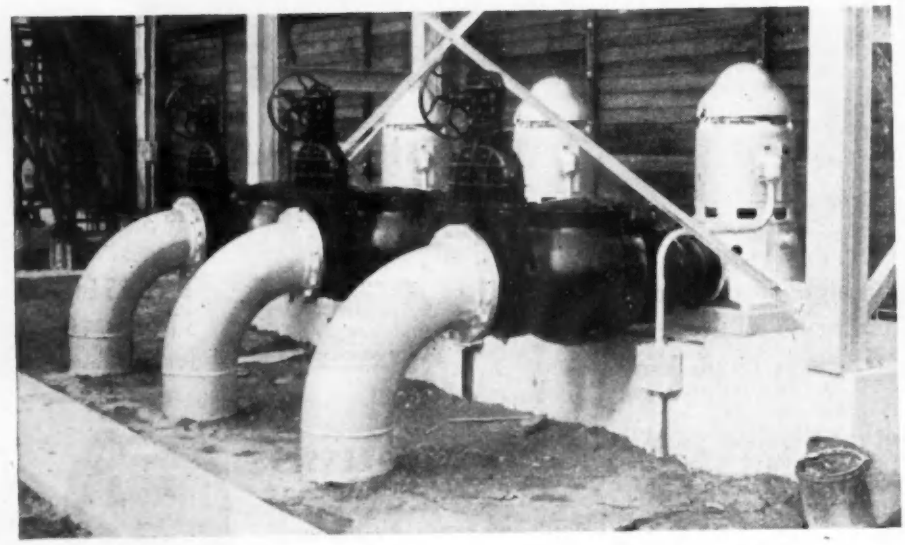

Farther up the line (lower left) this type of motor-driven pump is handling the cooling water over the tower. The gates and check valves are similar to those shown, while the unitized pumps and motors, having the same power and output characteristics, bear different nameplates from those shown in the view directly above. Use of prefabricated ells made the piping problem largely one of welding to plan.

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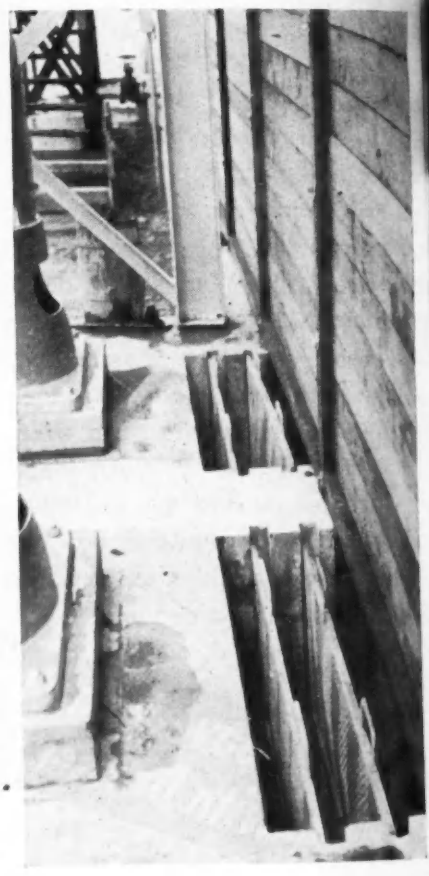

Ingenious screens protect the spray water pumps from floating trash. Fitted into the weir at the edge of the tower collecting basin, the first screen carried ½-inch mesh, while the one nearer the pump has ¼-inch mesh. By pulling one screen at a time and cleaning it, the pump still has the protection of the other unit, and floating material is trapped before being in position to cause motor damage.

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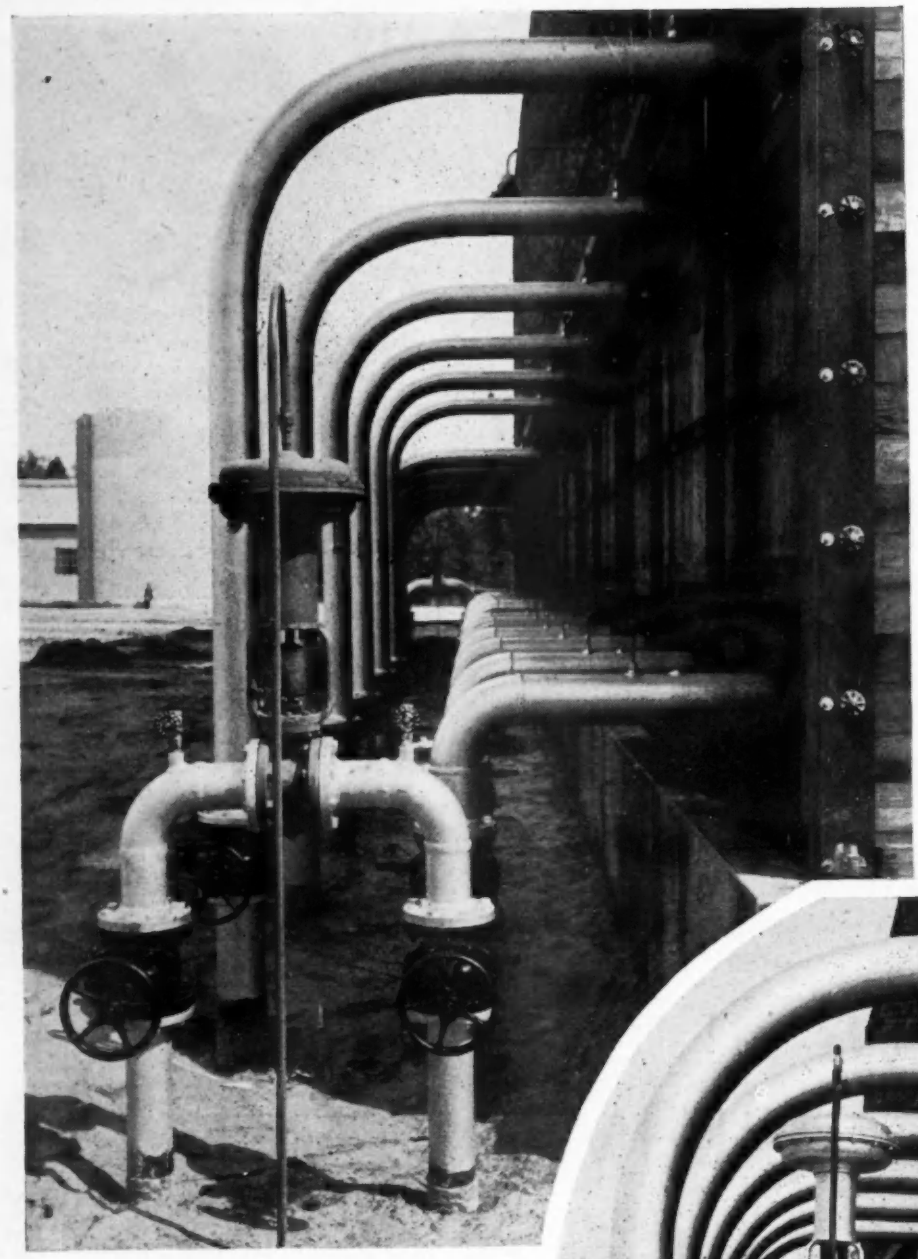

Division of the station cooling water into "hot" and "cold" systems, with a temperature differential of 20 degrees or more between them, causes the jacket water to be circulated through the tower heat exchangers in two separate circuits. Here the temperature control, individual valves and long sweep bands control the flow of the "cold" circuit to one of the towers on the lower end of the line.

The "hot" circuit is handled through this series of pipes and valves at Batesville, Miss. The loop in the foreground is equipped with a control valve, thermally actuated, which regulates the amount of hot water being bypassed to the return system, thereby preventing the cooled water from being pumped over the engines at a temperature below that desired. A similar bypass controls the "cold" line.

620 MILES OF THANKS AND SINCERE APPRECIATION

IN EXTENDING our genuine congratulations to the officials of the company, and the general contractors, Bechtel-Dempsey-Price, Williams Brothers Corp., and Swinerton & Walberg Co., the Parkhill organization wishes to express its appreciation for the privilege to participate in the construction of the strategically important Tennessee Gas & Transmission pipe line.

PARKHILL equipment and service was given the opportunity to prove its efficiency and experience in stringing 620 miles of 24" pipe on this project in Tennessee, Kentucky and Mississippi.

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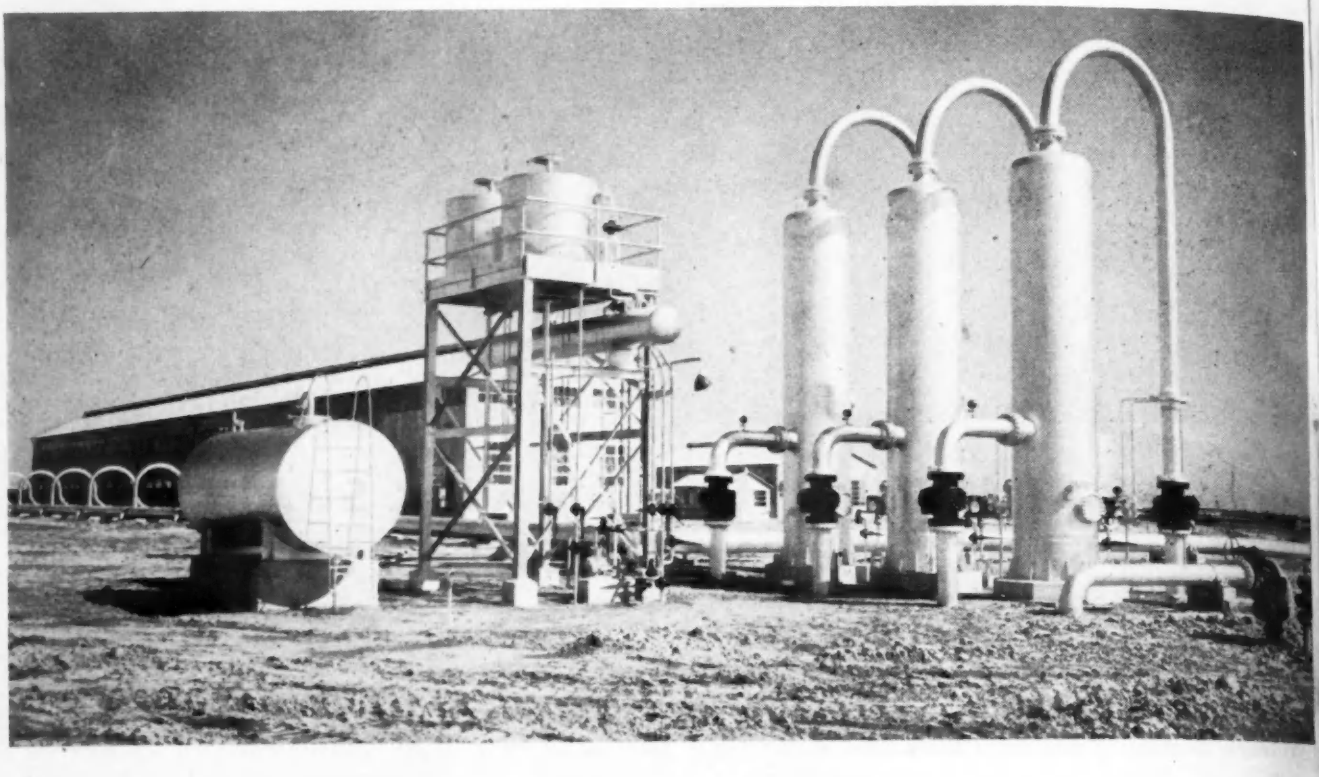

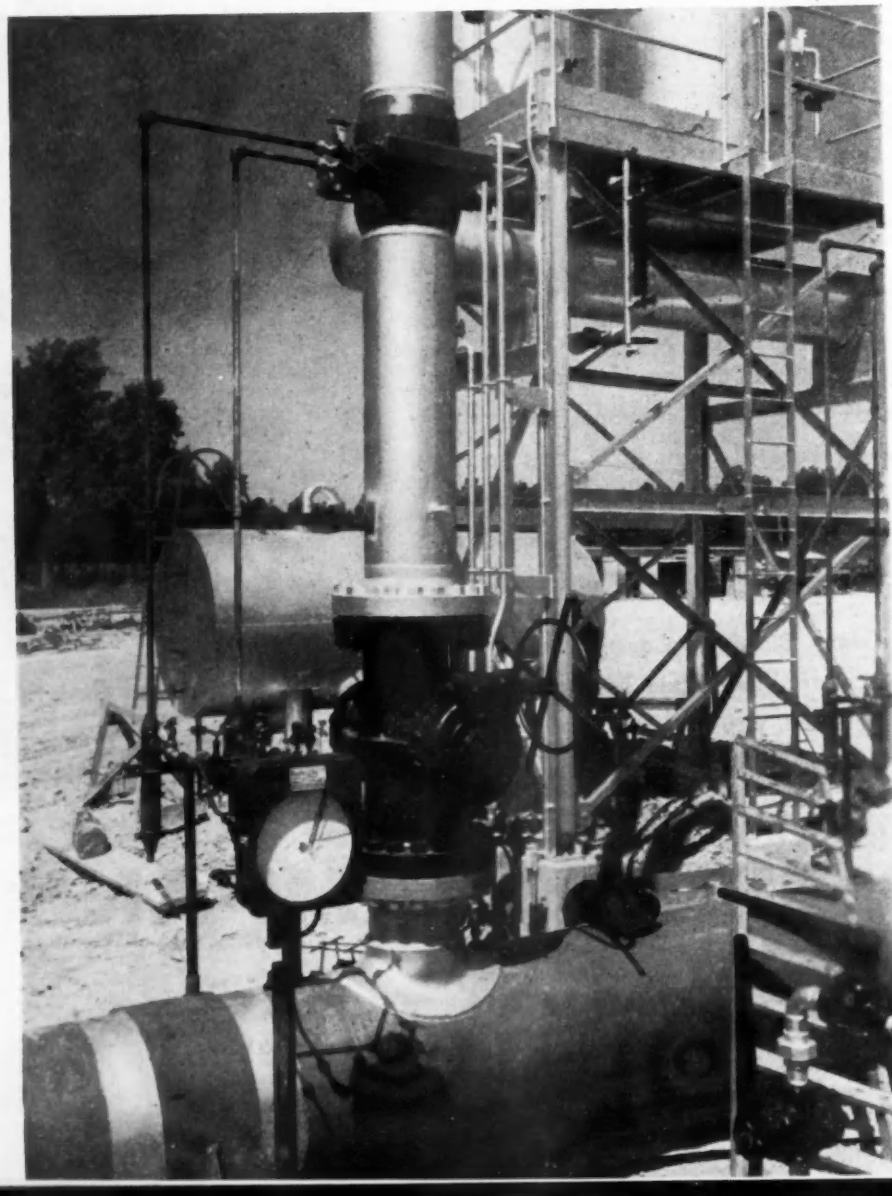

Gas from farther down the line enters a station through a set of three dust scrubbers, shown above, piped in parallel, with stub provision on the underground piping for a fourth unit when intermediate stations are put in. These scrubbers are designed for 786-pound working pressure with a capacity of 75,000,000 feet of gas per 24 hours. Dirty oil from the scrubbers enters either of the settling tanks shown at the left, being drawn off after settling into the charging tank. The horizontal tank carries reserve or make-up stock of scrubber oil, which may be transferred to charging tank by the same pump which normally operates to unload the settling tanks. Vents, hatchways and other openings in the scrubber oil settling tanks are made completely weatherproof to exclude water entry, with consequent contamination of the dehydrated gas in the line. Each scrubber may be bypassed through a 12-inch loop, equipped with block valve.

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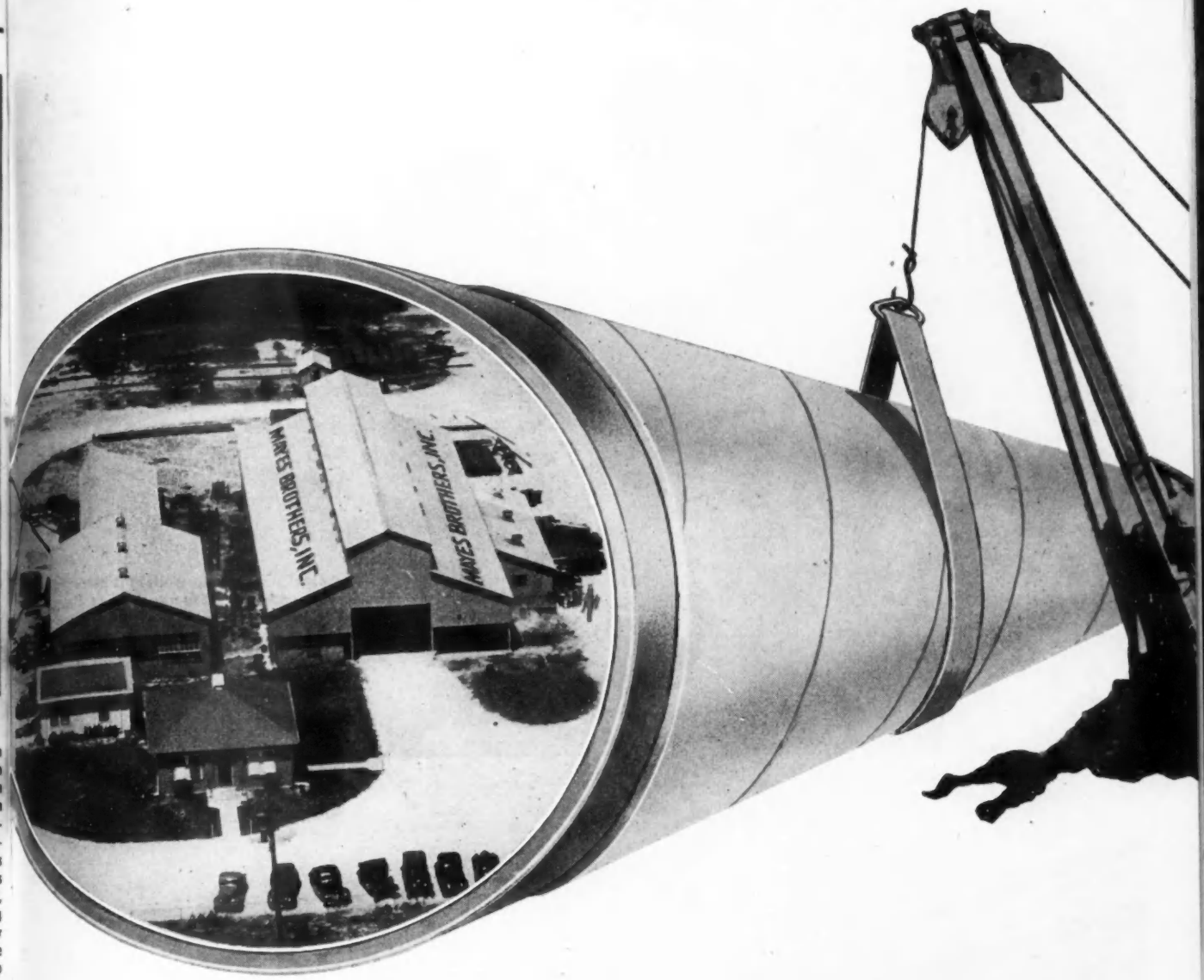
A close up of the controls and checking instruments on one of the scrubbers appears at left. In the vertical pipe which serves as run is set the orifice meter to provide a check on the amount of gas being handled by the scrubber. These recording flowmeters are not corrected for temperature, and do not serve to measure the exact volume entering the station. They are primarily for the purpose of providing equalized distribution to the three scrubbers, though they may be used to obtain approximate check on the throughput being handled.



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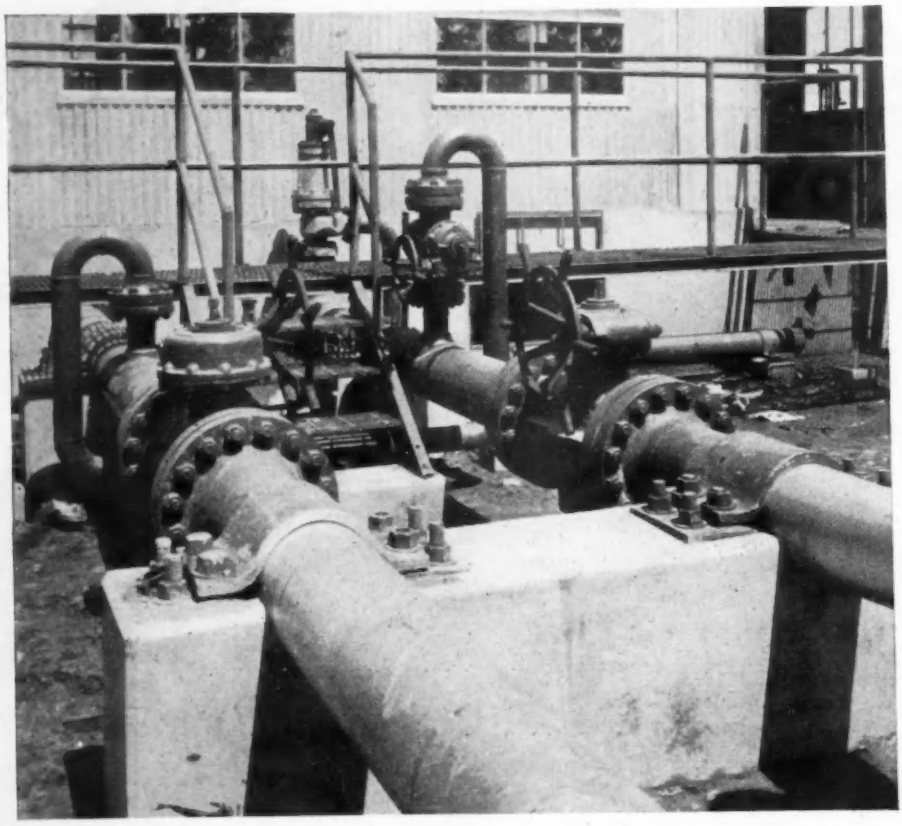

The photograph at left shows a pair of branches which serve to tie each compressor unit to the intake and discharge lines of the gas main. At the left is seen the suction line, set in as a straight line from the header, and equipped with block gate and downstream end of the bypass loop. The other line is provided with an automatic pressure relief valve, vented to air at the end of a long waste line, and with hand operated emergency feature. The manually controlled bypass valve is mounted on this line, with a riser and return bends to tie in with the suction lines. These connections are between compressor manifold and block gates, permitting any compressor to be isolated for test purposes.

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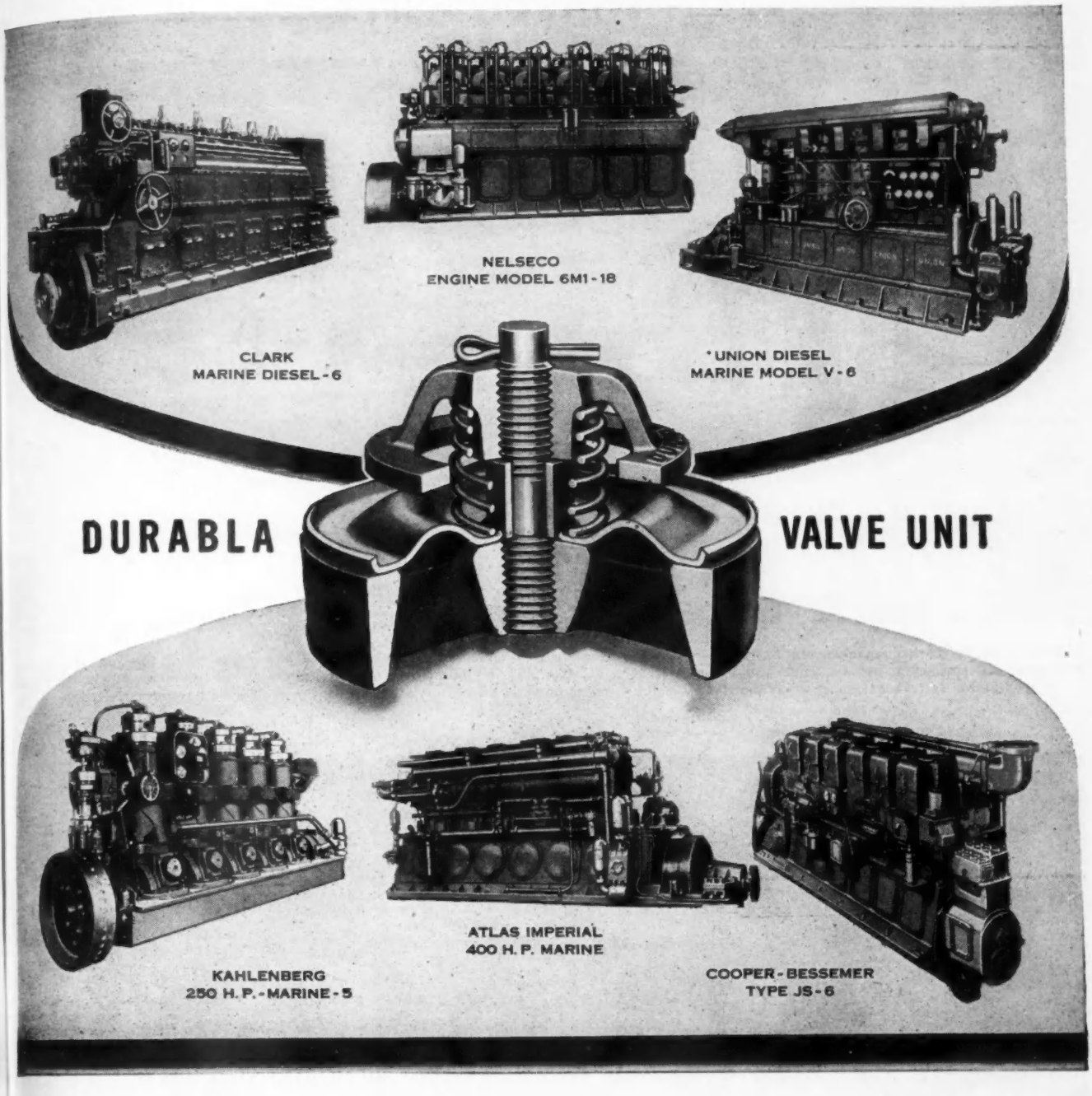
A typical station gas manifold is pictured below. In this case the discharge line to the cooling tower and thence to the next compressor station is taken off from the center of the collector manifold, with provision for expansion travel toward both ends. At other stations the flow is all in one direction, with the farther end of the manifold continuing directly to the distribution piping at the cooling tower. The expansion loops in the discharge lines from the individual compressors are designed to relieve expansion and shift stresses.



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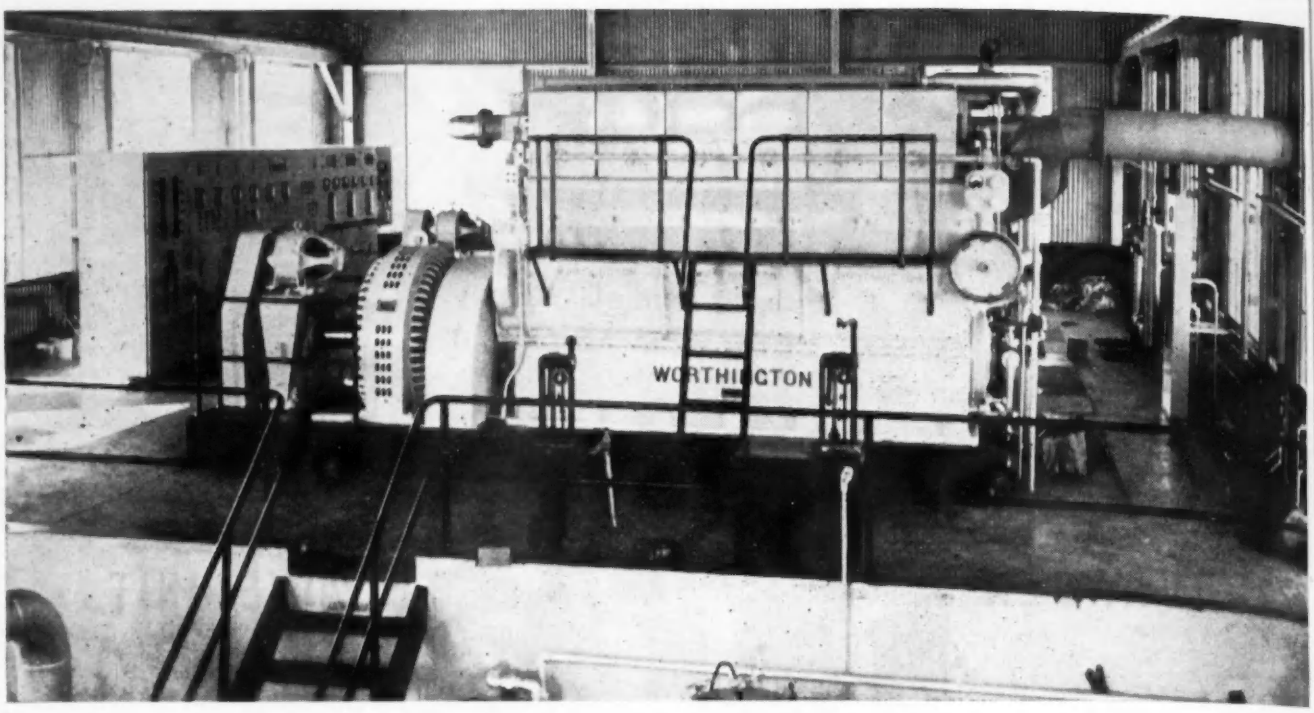
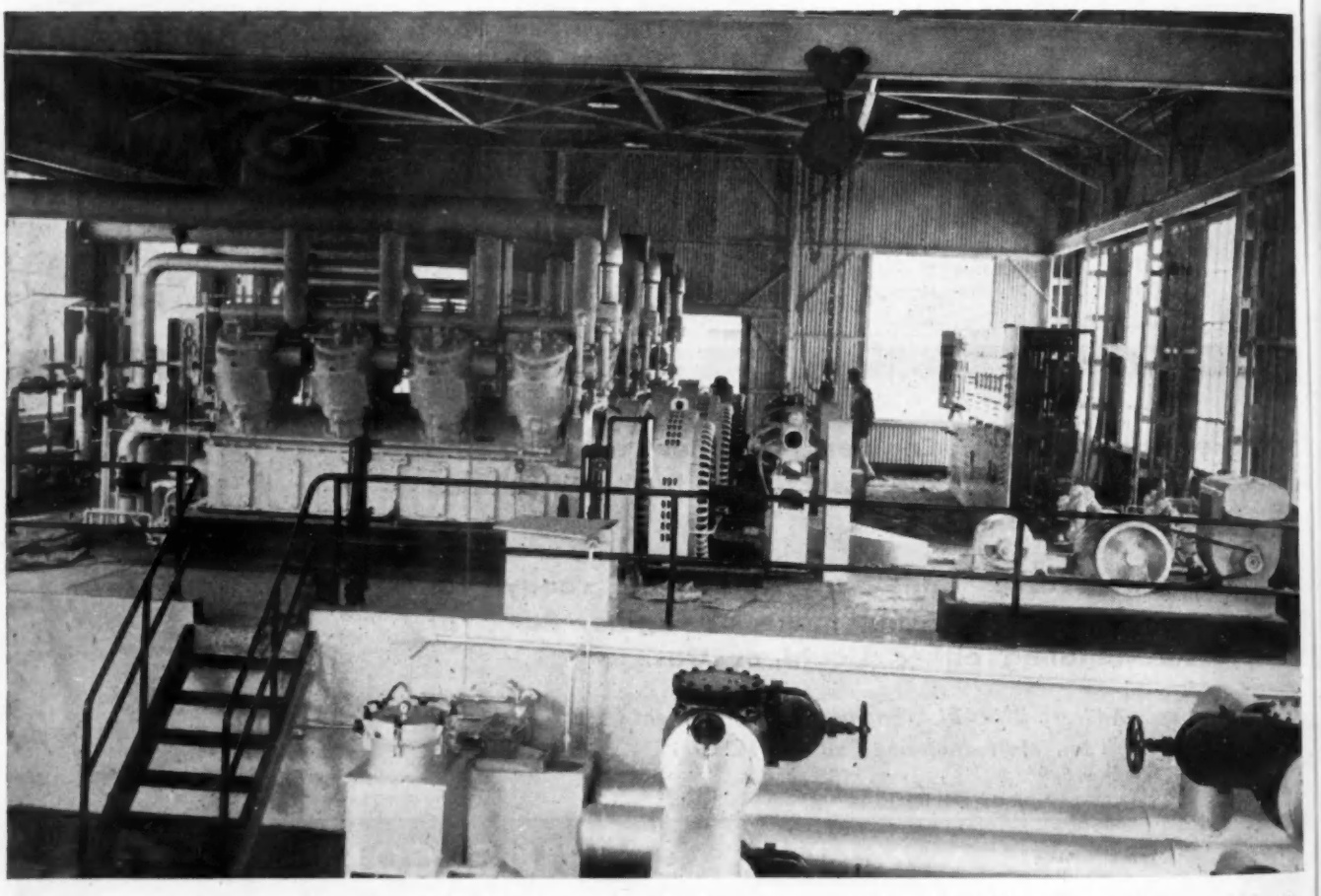


Electric power for each compressor station is generated in a separate power plant, individually housed, the lower end of the line being powered with three 400-horsepower engines, each direct connected to a 312-Kva 480-volt 60-cycle generator, furnishing all power needs through a push-button switchboard panel which controls all motor drives throughout the station setup, as well as regulating lighting circuits.



The power plant building is equipped with overhead hand-operated chain hoist on a crane with capacity sufficient for any maintenance load within the station. This view shows the interior of a power building at Station 8, Batesville, Miss., with three 370-horsepower engines driving generators similar to those illustrated above. Excitation is by belt-driven 7½ KW, 125-volt exciters.

A quarter century with SKELLY

SKELLY OIL COMPANY was founded October 2, 1919. Beginning as a relatively small producer of crude oil and natural gasoline, it now embraces all major departments of the industry and covers the middle one-third of the United States. In the twenty-one states in which Skelly operates, its trademark is respected as a symbol of sound policy and fair practice.

Skelly is proud of its place in the American oil industry . . . proud to have a part in the current wartime miracle of petroleum supply. For the duration of the war Skelly's paramount aim is to make utmost contribution to the success of American arms. At the same time Skelly is looking forward to the return of normal business after the war and aims to have ready an organization, methods, and products that will keep the company abreast of progress in the postwar era.

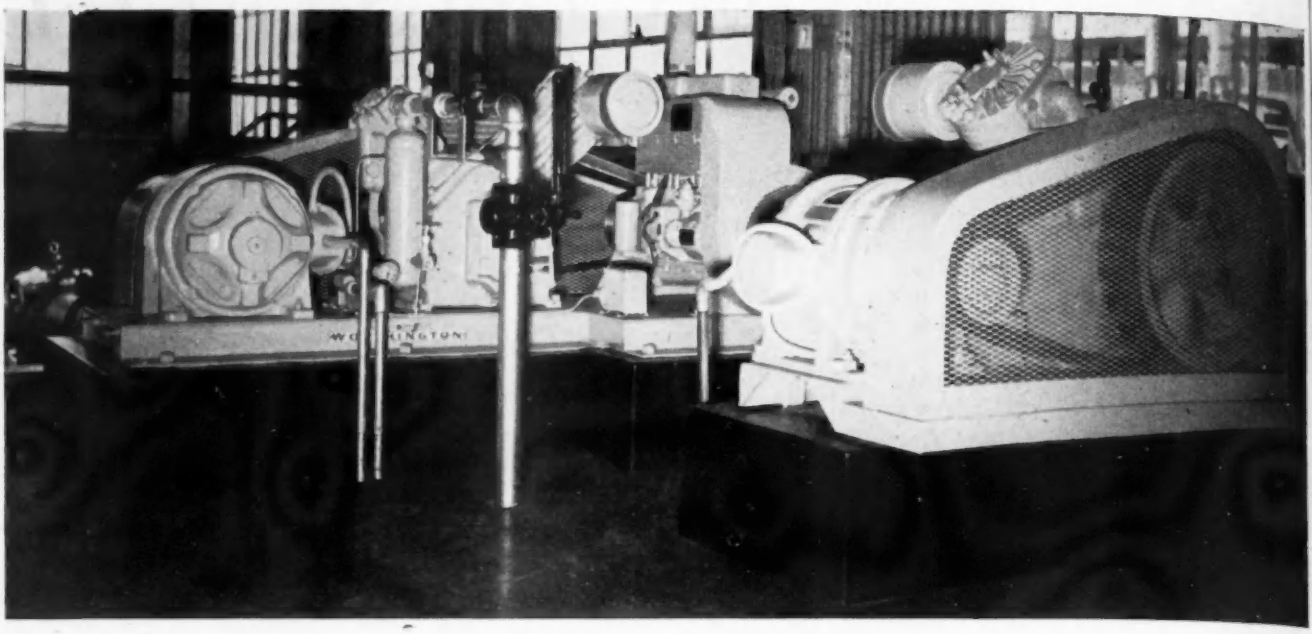
As Skelly enters its second quarter century, it renews its pledge made 25 years ago and never forgotten—to provide the highest quality of products that modern equipment, technical skill and experienced personnel can produce, and gratefully to serve the loyal customers whose patronage has made possible the company's success.

"The best we have today— SKELLY *must be made better tomorrow"*

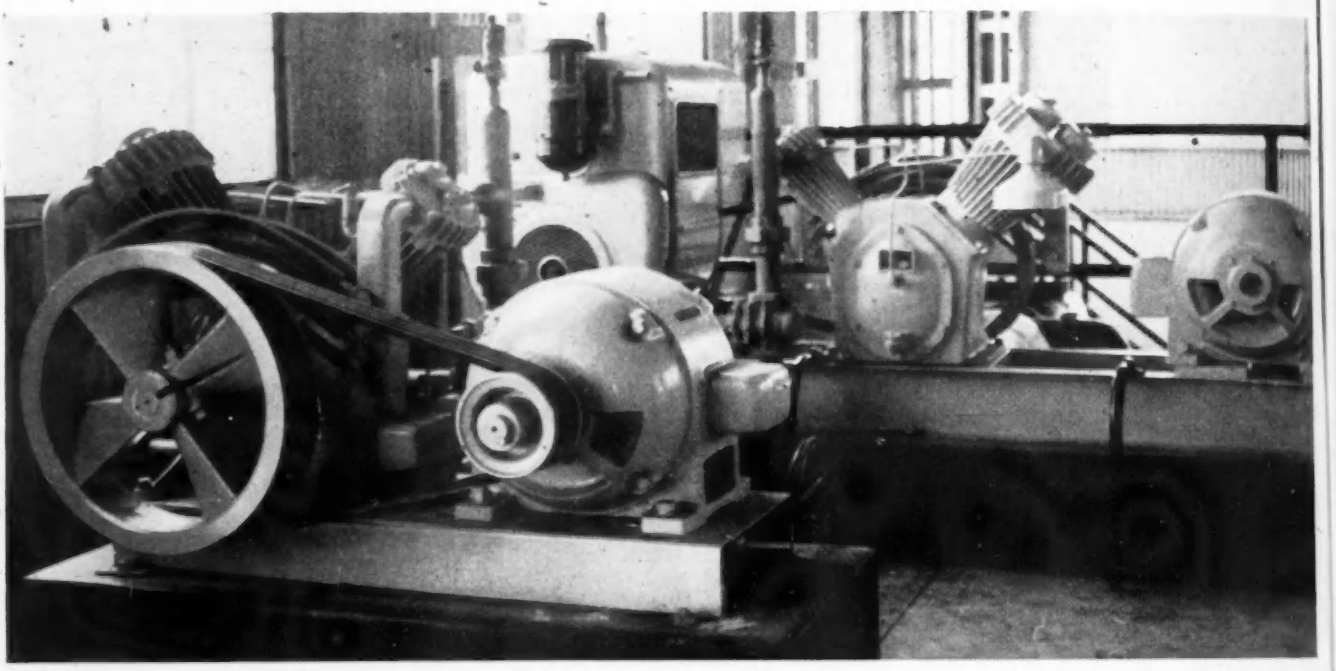
SKELLY OIL COMPANY

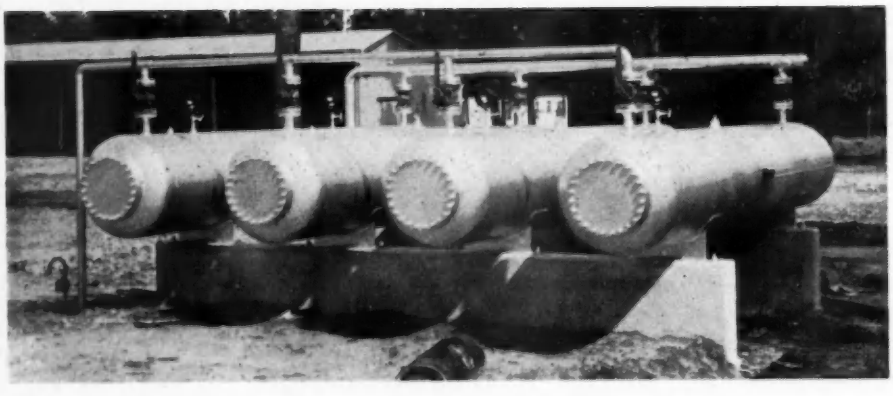
Tulsa, Oklahoma **Kansas City, Missouri**

Eldorado, Kansas



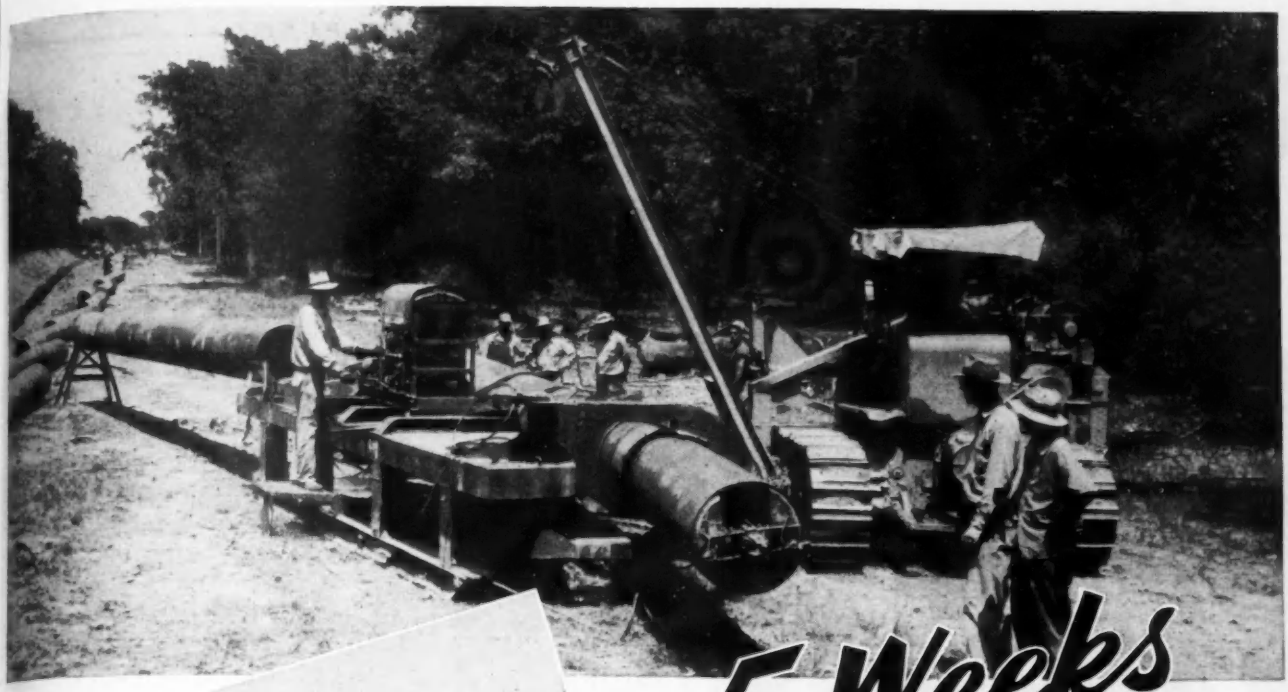
A compact starting-air compression setup is a feature of all the stations. Here, at Station 2, the dual drive compressor is shown in the center, with pulleys and center distances so laid out that the same set of V-belts will serve to drive the standby gasoline engine in the corner, or will connect the electric motor to the compressor if the power plant is delivering electrical energy to the lines.





In the above setup, typical of the upper end of the line, the location of units is reversed but with similar paired compressors, one set up for the V-belt drive from a motor, the other arranged to be dually driven at option. All compressors are of the same capacity, giving each station 80 cubic feet of air per minute at a storage pressure of 250 pounds per square inch, at which figure it is piped to the starting manifolds.

Starting air from the compressors is brought to these outdoor storage tanks, each 30-inch diameter by 15 feet in length, and designed to be operated at 250 pounds, gauge. Each tank is equipped with pressure gauge and relief valve, as well as cut-off and drain valves.



5 Weeks to Spare

We completed ... five weeks in advance of contract time limit ... Section 2 (120 miles) of Tennessee Gas & Transmission Company's 24-inch natural gas line despite handicaps of quicksand, rice fields and 40 inches of rain.

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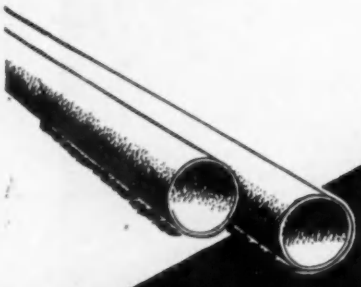

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This organization has a rich background of experience which can be of important advantage to you. Every key man is a graduate mechanical or civil engineer, and has had actual experience in industrial and process piping. Our successes include the WEP Products Line, the world's largest rubber plant, TNT Processing, power plants, and utilities. Twenty-five years' experience in industrial piping alone. Our equipment is modern, our manpower the very best.

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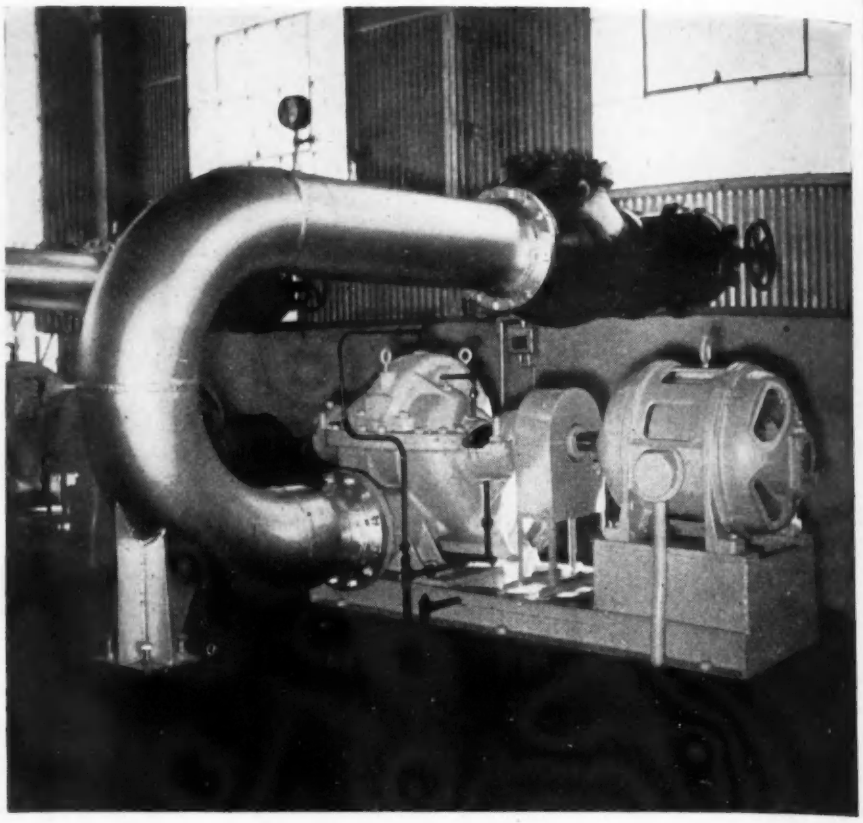
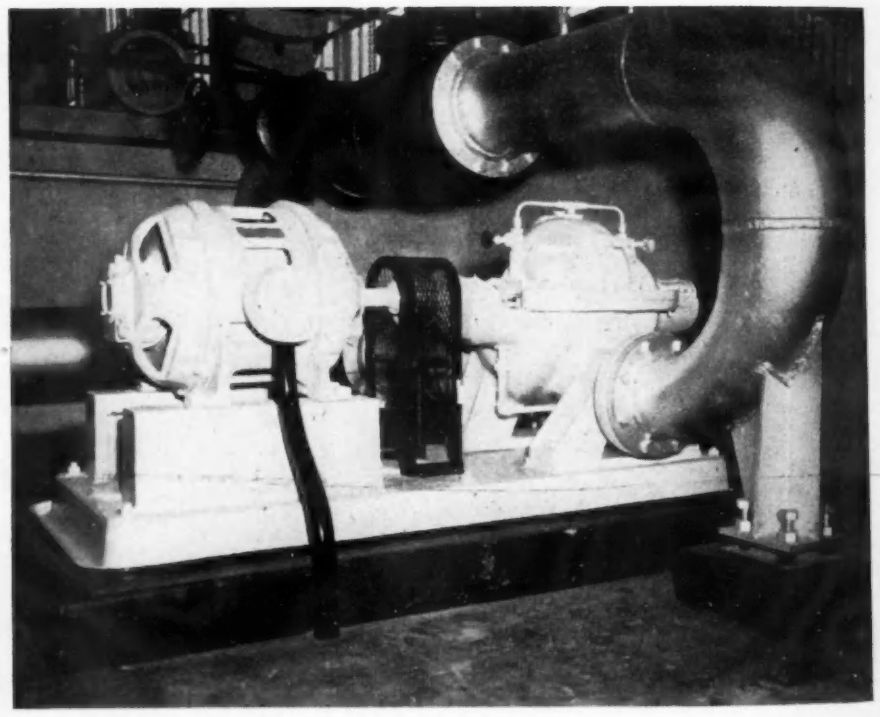
T-G-T POWER PLANT



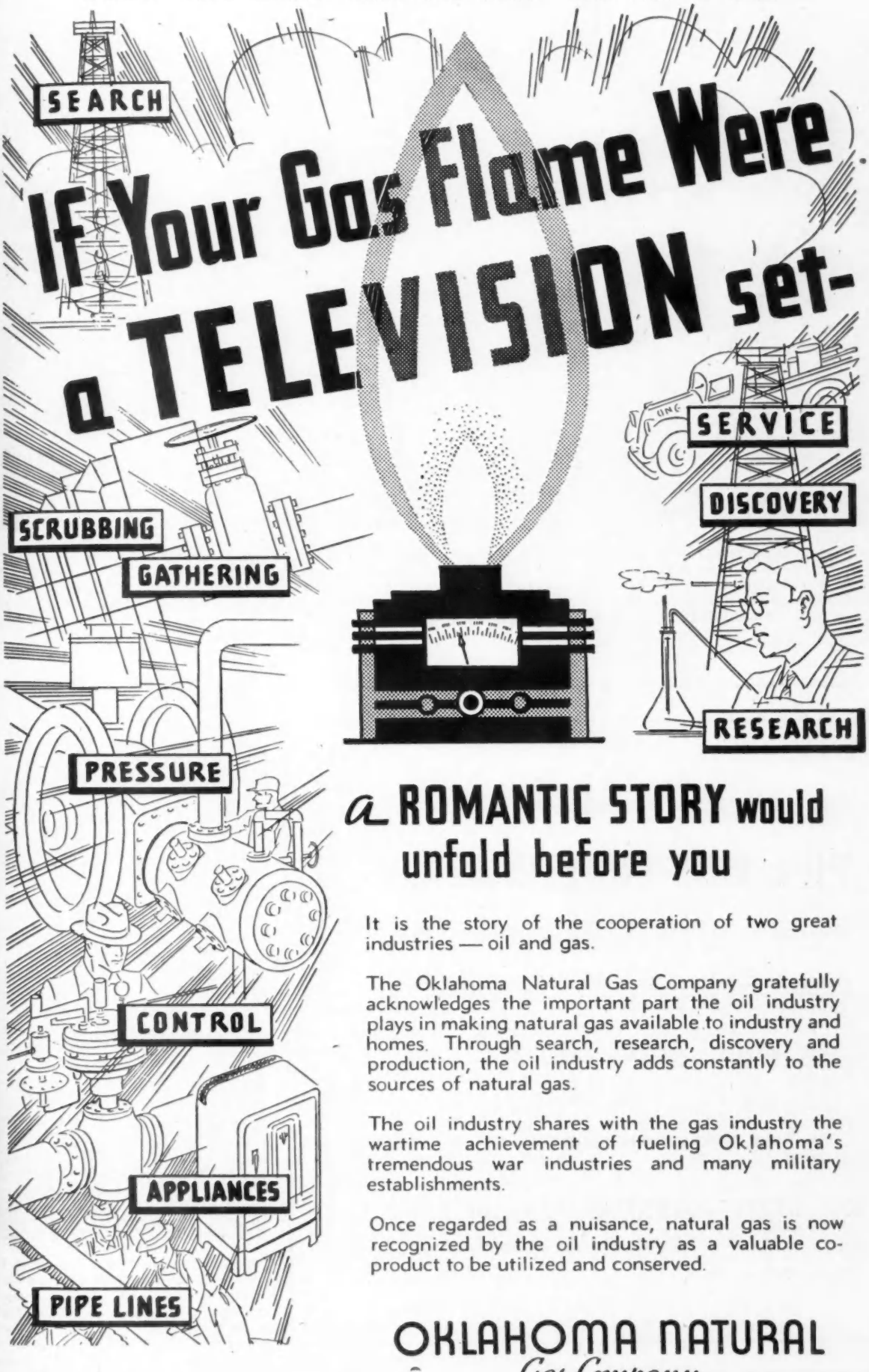
Pumps for circulating water through both jacket cooling systems are located in the power plant building, being set in a depressed section of the floor to allow delivery and suction lines without vertical loops. Two motor driven centrifugal pumps with capacity of 3600 gallons per minute serve to handle the water for the "hot" side of the system, a third identical unit being installed for emergency use.



The "cold" circulating circuit requires a flow of 1335 gallons per minute in the lower stations, and 1850 gallons per minute beyond the Mississippi River, this pump being sufficient to handle this quantity through a 20-foot high surge tank and through the parallel cooling banks in that section of the cooling tower. This pump is matched by a similar spare, either being cut into the circuit manually on short notice.

THERE'S MORE BEHIND YOUR GAS FLAME THAN JUST A WELL

If Your Gas Flame Were a TELEVISION set-



a ROMANTIC STORY would unfold before you

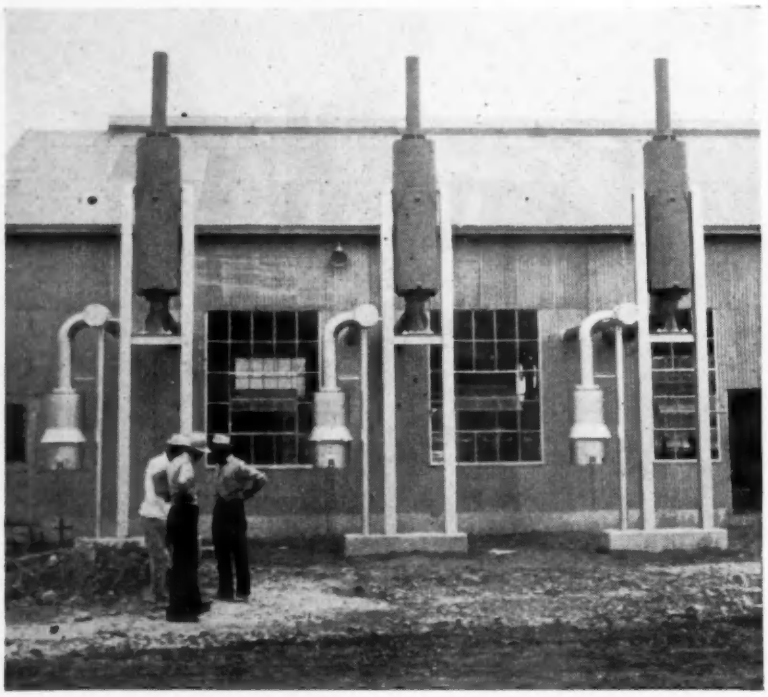
It is the story of the cooperation of two great industries — oil and gas.

The Oklahoma Natural Gas Company gratefully acknowledges the important part the oil industry plays in making natural gas available to industry and homes. Through search, research, discovery and production, the oil industry adds constantly to the sources of natural gas.

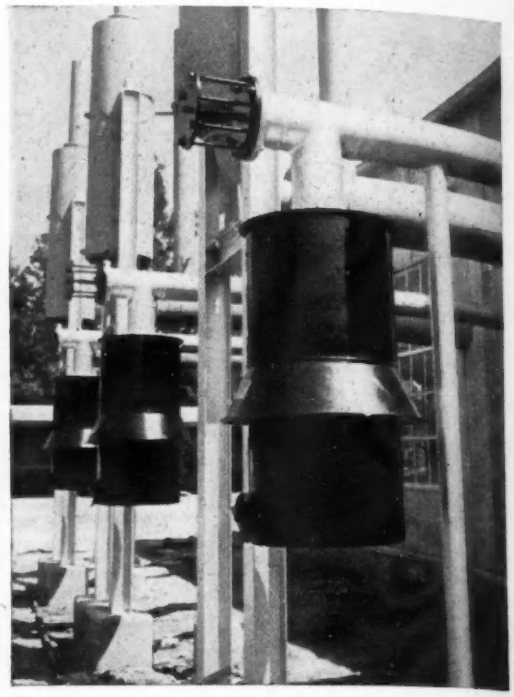
The oil industry shares with the gas industry the wartime achievement of fueling Oklahoma's tremendous war industries and many military establishments.

Once regarded as a nuisance, natural gas is now recognized by the oil industry as a valuable co-product to be utilized and conserved.

OKLAHOMA NATURAL
Gas Company



One end of a typical power plant building, showing the silencers and the intake air lines with separate air cleaners for each engine. The cleaners are offset on a drop leg through an elbow let into the suction line at right angles to provide straight-line path for backfire should one occur, the backfire relief valve capping the end of the straight run and being held in place by light coil spring.



Close up view of another set of air intake lines for the power units. In this set-up the cleaner is set directly below the intake, but the same straight-line backfire path is provided the plate held against the large diameter orifice in the sealing flange of the relief fitting.

Dependable

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We can please you because good work always comes first with us. Our record speaks for itself.

- Years of successful experience
- Competent, skilled crews
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OIL STATES CONSTRUCTION COMPANY

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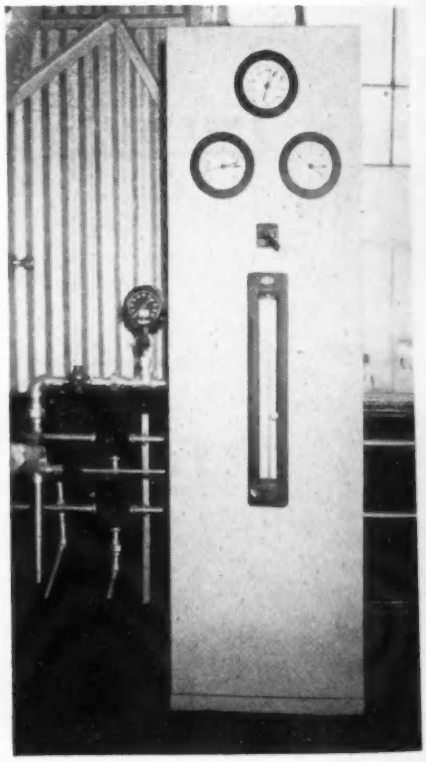

This gauge panel provides a check on fuel gas pressure to the generating unit engines as well as showing cooling water and oil temperatures of the unit. The gauges are readily visible from across the station and down the operator's side of the engine. Behind the panel may be glimpsed the fuel manifold and pressure regulators for maintaining manifold loadings.

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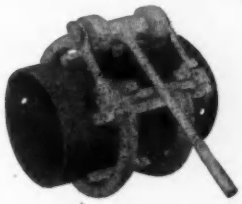
PIPE LINE SUPPLIES



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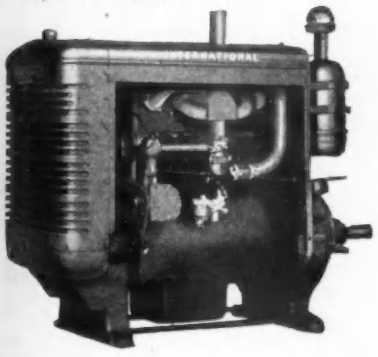

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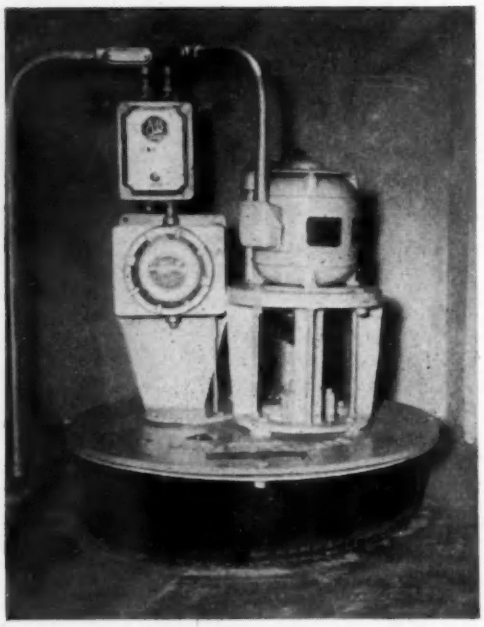
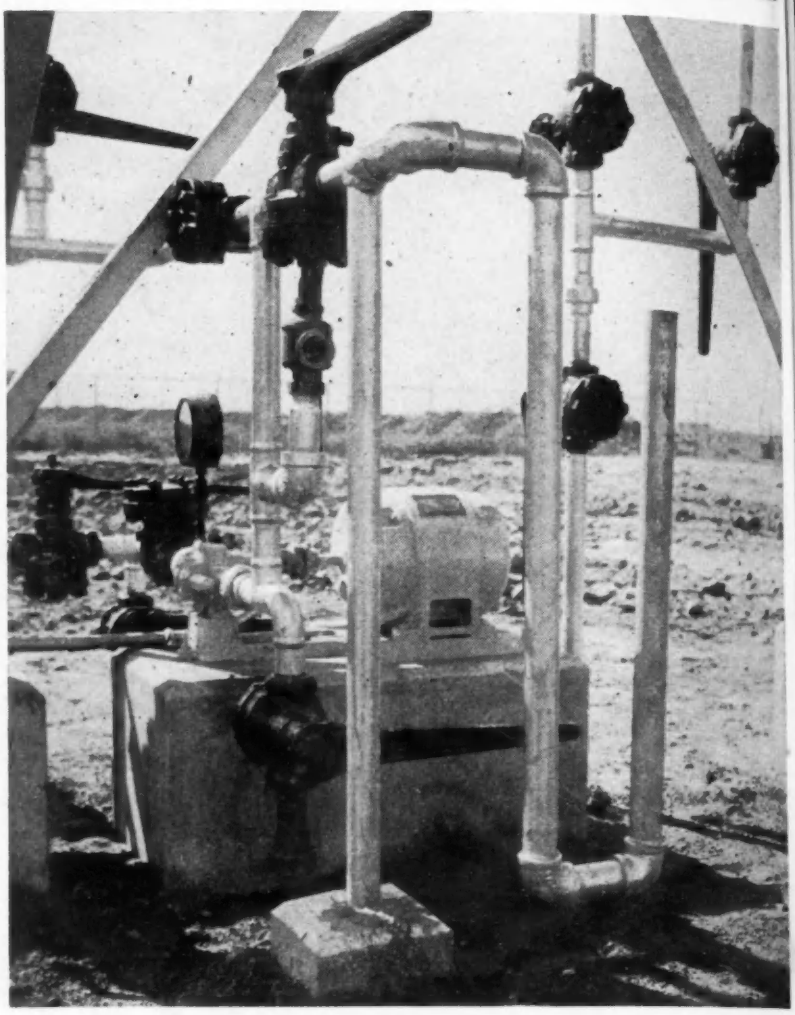
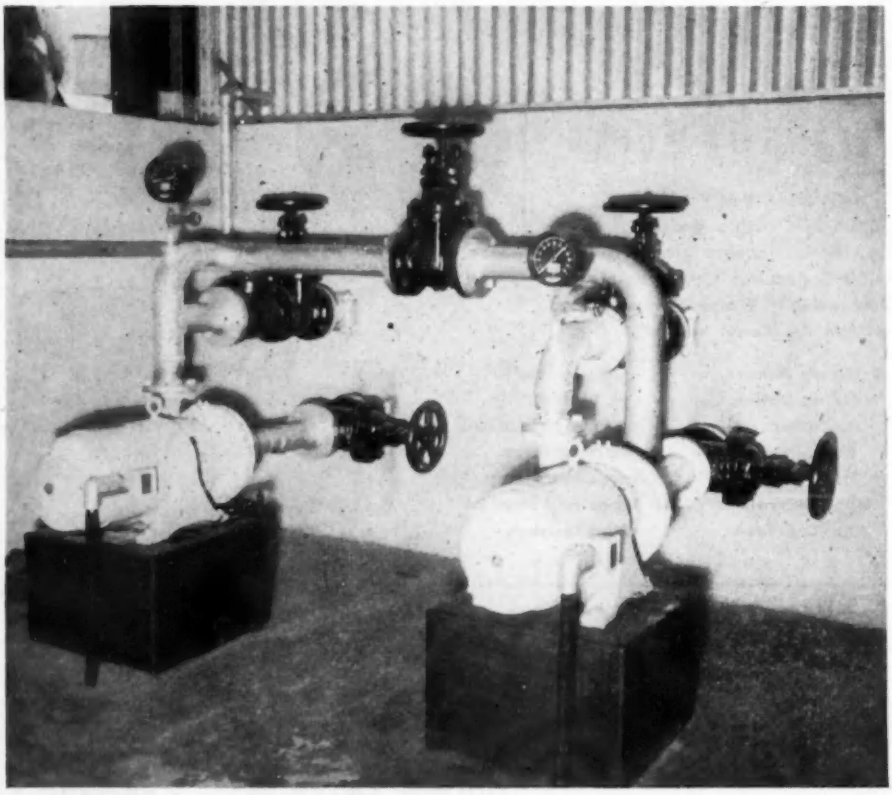
TULSA, OKLAHOMA . . . Phone 8191 **GUTHRIE, OKLAHOMA . . . Phone LD 1**



Small pumps are distributed around the plant where needed. Above photograph shows direct-connected pump and high-volume, low-head pump mounted on a strainer body in the lowest corner of the power plant pump room. The unit is self-priming, and automatically handles any accumulation of water.



Perhaps the smallest pump on the entire system is the 14-gallon per minute herringbone gear type unit with built-in safety valve, shown at right. This pump takes suction from the scrubber oil settling tanks and discharges into the filling tank. The swinging U-shaped line is vent and blowdown.



The first four stations as at present installed depend on driven water wells for make-up and camp supply. Electric motors drive the 200-gallon per minute deep well pumps at these installations, the one at Station 4 being shown above, the view being taken before wiring.

Raw water from the yard storage tanks at such stations as have elevated storage tanks is taken from the big tank and elevated through one or both of such unitized centrifugal units as pictured at left, the elevated tanks providing flow pressure for office and station personnel lavatory requirements.

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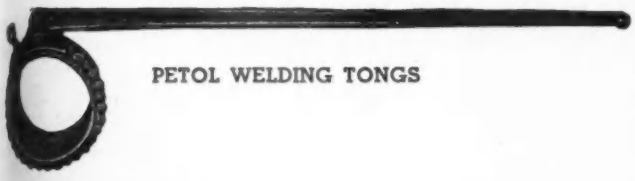
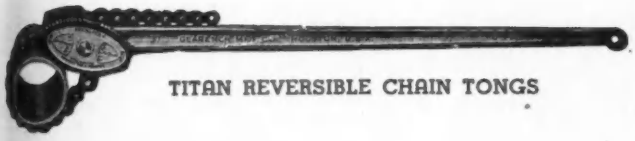


PETOL WELDING TONGS



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TITAN PIPE TONGS

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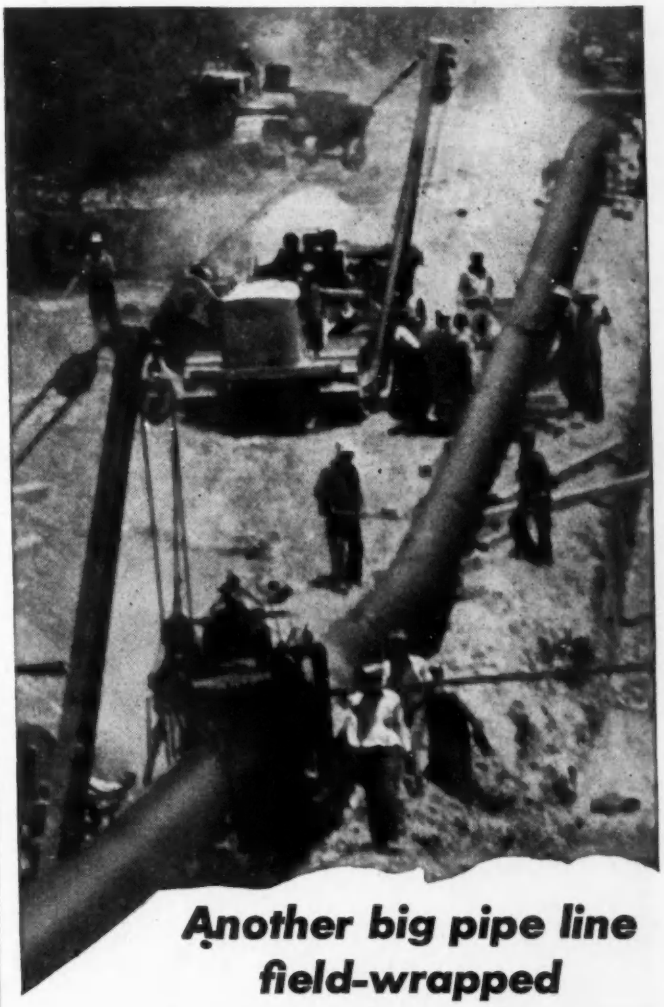

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For full details on how the J-M Coating and Wrapping Machine and J-M Asbestos Pipe Line Felts can guard your own lines against corrosion—and save you time and money in your pipe-wrapping operations—write Johns-Manville, 22 E. 40th Street, New York 16, N.Y.

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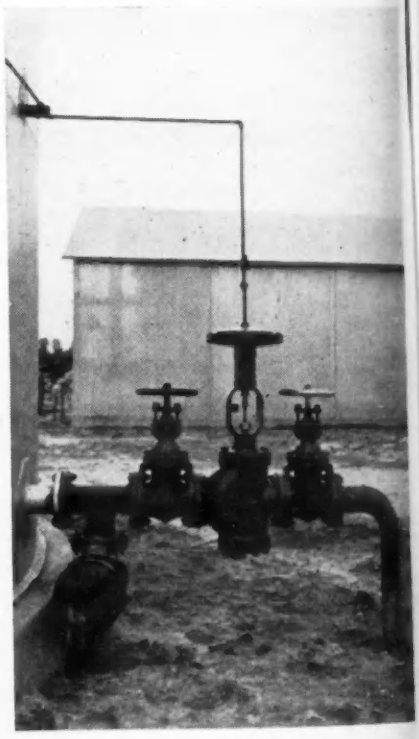
—T-G-T POWER PLANT—

At Station 8 and beyond, a 60-foot section of the 24-inch line pipe, with reinforced base section, serves as pressure source for the station raw water supply. Pressure to fill these units is put up by electrically operated single-stage centrifugal pumps.



Control of the water level within the 2000-barrel main storage tank is through this regulator, so arranged as to cut off flow and shut down the well pump when the water level approaches the top, and to cut in the flow as the storage falls below rated minimum.

We are glad to have had a part in the Tennessee Gas & Transmission Company project by building bridges in Kentucky and Tennessee

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BRIDGES
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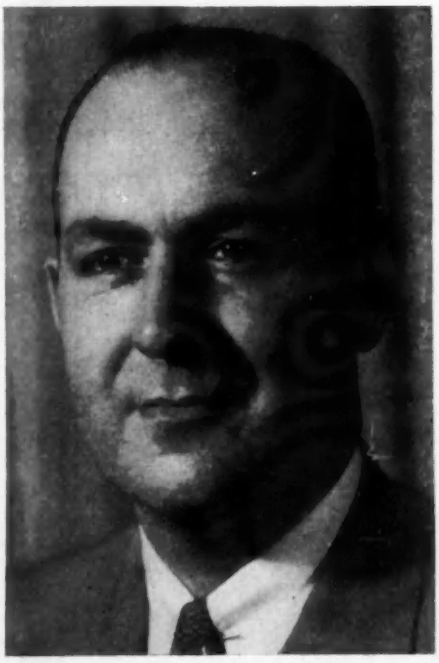
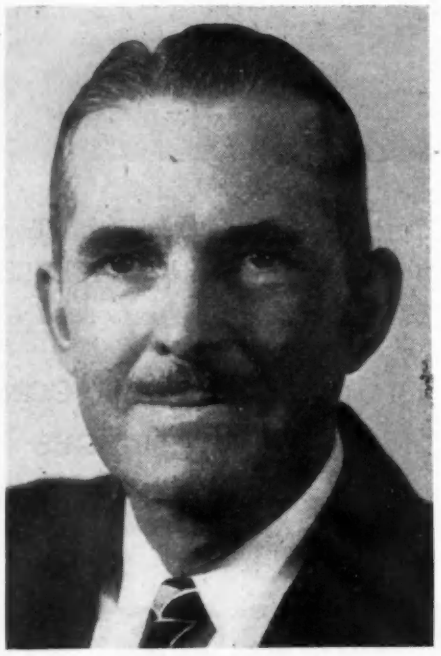
RICHARD WAGNER, CHAIRMAN OF THE BOARD. Born: June 15, 1896, New York City. Residence: Park Ridge, Illinois. Education: Public school in Chicago. Business experience: Continental & Commercial National Bank, Chicago, from 1910 to 1930, first as secretary to the president, and then vice president; The Chicago Corporation from 1930 to date, first as vice president and since 1938 as president and director; chairman of the board of Tennessee Gas and Transmission Company upon company's organization in 1943. Also director of following firms: Parkersburg Rig & Reel Company, City National Bank & Trust Company, American Automobile Insurance Company, Associated Indemnity Corporation, Associated Fire & Marine Insurance Company, Fort Dearborn Mortgage Company, and Gulf Plains Corporation.



HENRY GARDINER SYMONDS, PRESIDENT. Born: Pittsburgh, Pennsylvnia, October 15, 1903. Residence: Houston, Texas. Education: B.A. Degree in Geology, Stanford University; M.B.A. (with distinction) Harvard Graduate School of Business Administration. Business experience: Illinois Merchants Trust Company and its successor, Continental Illinois National Bank and Trust Company, from 1924 to 1930; The Chicago Corporation from 1930 to date, first as assistant treasurer, as vice president from 1932 to date, as director from 1940 to date; president, Tennessee Gas and Transmission Company, 1943 to date. Also director of following firms: Fort Dearborn Mortgage Company, General Telephone Corporation, Stewart-Warner Corporation, and Gulf Plains Corporation.



RAY C. FISH, VICE PRESIDENT IN CHARGE OF ENGINEERING AND CONSTRUCTION. Born: Tiverton, Rhode Island, March 6, 1902. Residence: Houston, Texas. Education: High school and three years college. Business experience: J. A. Campbell Engineering Company, engineering design and construction, 1927 to 1930; Stearns-Rogers Manufacturing Company, chief of engineering design and construction, oil and gas division, 1930 to 1943; Tennessee Gas and Transmission Company, vice president in charge of engineering and construction, 1943 to date.

BINFORD ARNEY, VICE PRESIDENT AND COUNSEL. Born: September 11, 1908. Residence: Austin, Texas. Education: Pre-law at Cornell and Northwestern Universities: LLB Degree, Drake University. Business experience: Member, legal firm of Small, Arney & Small, 1932 to 1944; Tennessee Gas and Transmission Company, vice president and counsel, 1944 to date.

W. E. MUELLER, VICE PRESIDENT AND TREASURER. Born: Calamus, Iowa, March 10, 1911. Residence: Houston, Texas. Education: Public schools, Calamus, Iowa; B.S. Degree, University of Iowa, College of Commerce. Business experience: Associated with Arthur Andersen & Company, Public Accountants and Auditors, 1932 to 1940; The Chicago Corporation, Oil and Gas Division, and subsidiaries, first as comptroller, 1940 to 1943; then Tennessee Gas and Transmission Company, as vice president and treasurer from 1943 to date.

WILLIAM BUNKER POOR, CHIEF ENGINEER. Born: Weymouth, Massachusetts, October 11, 1901. Residence: Houston, Texas. Education: B.S. Degree in Mining Engineering, Ohio State University. Business experience: Ohio State Highway Department, assistant division engineer, 1926; Fairbanks Exploration Company, field engineer, 1926 to 1928; Columbia Gas & Electric Corporation, assistant engineer, 1928 to 1930; U. S. Smelting, Refining and Mining Company, field engineer, 1930 to 1931; United Gas Public Service Company, transmission engineer, 1931 to 1936; United Gas Pipe Line Company, supervising engineer, 1936 to 1944; Tennessee Gas and Transmission Company, chief engineer, 1944 to date.

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WOOD ENGINEERING AND CONSTRUCTION CO.

25 years experience, backed by the most modern and complete equipment enables us to handle any pipe line construction job.

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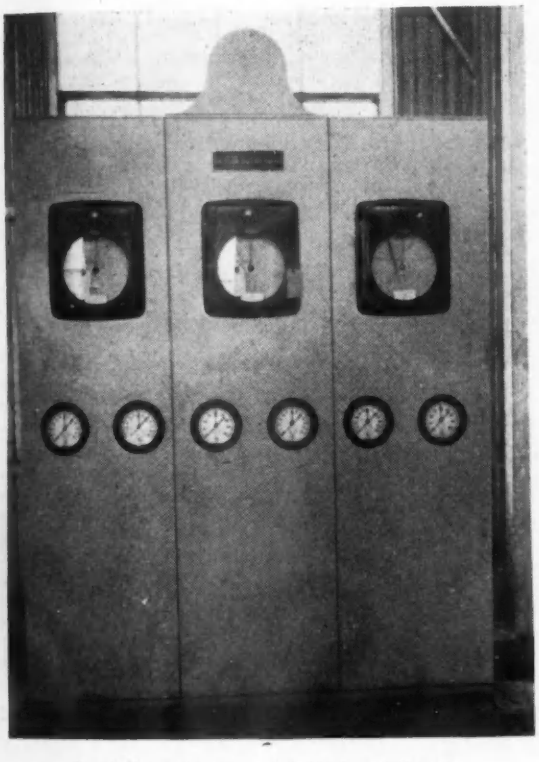

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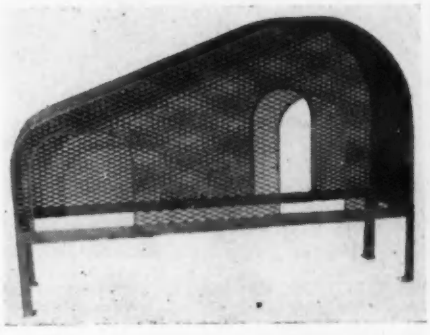
That we were selected to furnish the following products on this project is further proof that our high standard of quality and our earnest desire to give superlative service is appreciated by leading companies.

1. **PANEL BOARD**—specially designed and built to customer's specifications.

2. **SAFETY MACHINERY GUARDS** of various kinds—built to customer's specifications.

3. **SIGNS** over entrance gates—now being furnished.



One of the various kinds of Safety Machinery Guards furnished for this job.

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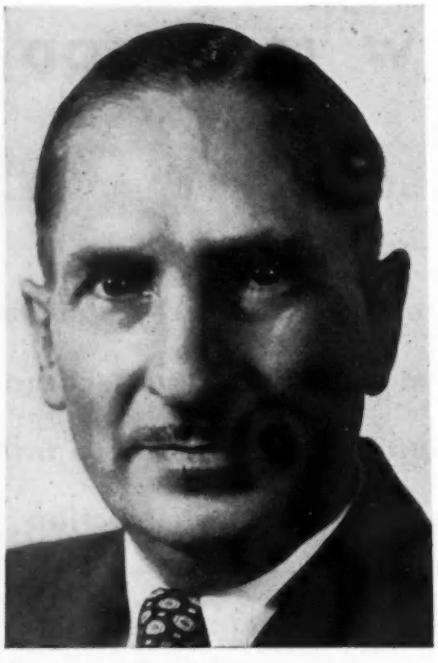
PHONE: C-4-4703

P. O. BOX 1453 **HOUSTON 1, TEXAS**

WILLIAM C. NORMAN, ASSISTANT TO PRESIDENT. Born: Teague, Texas, 1915. Residence: Houston, Texas. Education: Graduate accountant. Business experience: Arthur Andersen & Company, public accountant, 1937 to 1938; Union Sulphur Company, cost analyst, 1939; The Chicago Corporation, Oil and Gas Division, assistant comptroller, 1940 to 1943; Tennessee Gas and Transmission Company, assistant to president, 1944 to date.



CARL MYERS, CONTROLLER. Born: Hamberg, Iowa, December 19, 1893. Residence: Houston, Texas. Education: B.C.S. and M.C.S. Degree, Highland Park College, Des Moines, Iowa; C.P.A., Iowa and Wisconsin universities. Business experience: Rees Gabriel & Company, and J. H. Queal & Company, accountant and manager, 1910 to 1917; Arthur Andersen & Company, public accounting, 1918 to 1919; Iowa Electric Light and Power Company, general auditor and treasurer, 1919 to 1944; Tennessee Gas and Transmission Company, controller, 1944 to date.

JOHN P. BRISTOW, MANAGER OF TRANSMISSION. Born: La Rue, Texas, July 8, 1900. Residence: Houston, Texas. Education: Texas A. & M. College. Business experience: Highway design and construction, drainage and irrigation work, waterwork design and construction, and railroad construction, 1920 to 1924; Louisiana Power Company, field engineer, 1924 to 1925; field construction and design engineer on number of natural gas pipe line jobs, 1925 to 1935; Railroad Commission of Texas, valuation engineer, 1935; Northern Natural Gas Company, 1936 to 1943, first as office engineer, then assistant to chief engineer, then superintendent of pipe lines, and finally chief engineer; Tennessee Gas and Transmission Company, as manager of transmission, 1944 to date.

Compressor Stations

■ CONTINUED FROM PAGE 131

tions 2, 4, and 6 for any buildings other than the ones which have been mentioned previously.

Provision is made in the auxiliary building at Station 8 for the installation of a future boiler.

All boilers are served by condensate return units. These units have their own makeup control, return tank for controlling makeup water and charging pump for boiler feed water. These units are mounted in the auxiliary building adjacent to the boiler.

The boilers are equipped with 20-inch x 25-foot self-supporting steel stacks.

At each station a 20-gallon automatic hot water heater is installed in the office and a similar heater of 30-gallon capacity is installed in the change room. These units will provide required hot water for lavatories and showers.

Maintenance Facilities

The maintenance building, which contains the shop, warehouse, and change room building, is 30 feet by 60 feet. The central section of this building, 30 x 30 feet, is given over to warehouse space; bins are built along the walls and a small closed space is provided for housing electrical material. One end of this building, 12 by 30 feet, is given over to a change room for employe use. This change room is fully partitioned off and is provided with adequate locker space, a wash fountain, a shower stall, and sanitary facilities.

The remaining space in the building, 18 by 30 feet, is used for a maintenance shop. This section is provided with a monorail and hoist. In Stations 2, 4, 8, 10, and 12 this shop is equipped with lathe, drill press, arbor press, grinder, welding equipment, and necessary tools to handle all but major repair work. The other station shops do not have machine equipment since they are located within easy range of large mechanical job shops. All station shops, however, can handle all minor repair work since they are equipped with the necessary hand tools.

SAE Fuels and Lubricants Meet to Be Held in Tulsa

Wartime advances in developing fuels and lubricants will be related to peacetime applications at the SAE national fuels and lubricants meeting November 9 and 10 in the Mayo Hotel at Tulsa.

SAE General Manager John A. C. Warner indicates that progress made during the war, particularly in solving problems of fueling and lubricating automotive equipment used on land, at sea, and in the air, is of pertinent interest to automotive engineers engaged in designing and producing war vehicles who later will be concerned with the engineering requirements of peacetime vehicles. Among technical subjects to be discussed at the meeting are testing procedures, development of special service heavy duty oils and greases, and progress in overcoming vapor lock.

B. E. Sibley, of Continental Oil Company, Ponca City, Oklahoma, is general chairman of the meeting.

Papers will be read by W. A. Wright, Sun Oil Company; Carl Georgi, Quaker State Oil Refining Company; C. B. Veal, manager, Co-ordinating Research Council, New York; SAE President William S. James; F. C. Burk, The Atlantic Refining Company; G. H. Cloud, Standard Oil Development Company; E. M. Barber, The Texas Company; and A. E. Robertson, Standard Oil Development Company.

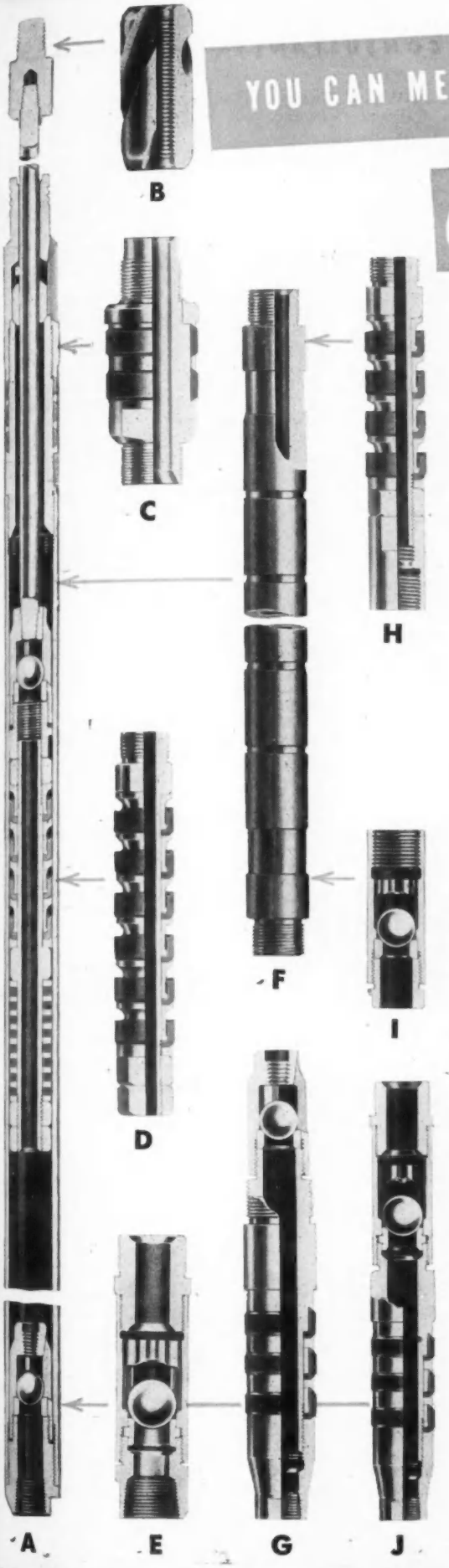
Gas Company Program

During the next year Oklahoma Natural Gas Company will spend $354,000 for drilling and equipping new gas wells and installation of additional equipment on present producing wells; $566,000 for construction of new transmission lines to tie into new gas sources, additional compressor stations, to replace obsolete lines and installations, and for other transmission service designed to improve present service, and $631,000 for distribution and general construction projects, Joseph Bowes, president, has announced.

Stanolind Buys Dickey

All of the common stock of Dickey Oil Company which owns producing properties in Oklahoma and Kansas including nine producing wells and proven acreage in the West Edmond pool, has been bought by Stanolind Oil & Gas Company, according to an announcement by Frank O. Prior, Stanolind president. Stanolind recently acquired all the capital stock of the Permian Oil Company which owns producing properties in West Texas.

YOU CAN MEET YOUR OPERATING CONDITIONS WITH "Oilwell" SUBSURFACE PUMPS



THE maximum interchangeability of "Oilwell" pump parts makes this possible. Most parts can be used in combination with all three types of "Oilwell" barrels—SILVERLINE, NICKEL-IRON and DI-HARD. Insert pump parts are interchangeable to a large degree between stationary-barrel and traveling-tube types.

Shown at the left is an "Oilwell" Silverline Stationary-Barrel Insert Pump with a few of the many interchangeable parts which can be combined in 16 different ways to meet various pumping conditions. It would be a simple matter to convert this pump to the traveling-tube type with a similar range of part combinations.

To help customers obtain the full advantage of the interchangeability of "Oilwell" subsurface pump parts, field stores have been equipped for assembling pumps to suit operating conditions. Men in the stores have been trained in correct practices and are provided with proper tools and equipment for handling pumps without damage to threads and wearing surfaces.

ILLUSTRATIONS:

- **A.** "Oilwell" Silverline Stationary-Barrel Insert Pump with top seating device, combination cup-and-ring traveling valve, and regular standing valve.
- **B.** Double-Box Fluted Coupling or Sucker Rod Guide.
- **C.** Oversize Top Seating Assembly.
- **D.** Cup-Type Traveling Valve.
- **E.** Oversize Standing Valve (for top seating).
- **F.** Nickel-Iron Corrugated Plunger (also furnished in other materials to suit conditions).
- **G.** Regular Standing Valve (for bottom seating).
- **H.** Four-Cup Upper Plunger Extension.
- **I.** Gas Valve for Plunger or Traveling Valve.
- **J.** Oversize Standing Valve (for bottom seating).

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Austin Bridge Company, Dallas, Texas—aerial crossings; Bechtel-Dempsey-Price, Lexington, Kentucky—main line construction; Brown & Root, Inc., Houston — main line construction; Coastal Water Well Company, Eldorado, Arkansas—water wells; J. R. Horrigan Construction Company, Houston—main line construction; Elmer R. Lapsley, Evansville, Indiana—water wells; Holloway Welding Works, Shreveport, Louisiana—tie-in to Southern Natural Gas Company; Henry Lemons & Company, Corpus Christi, Texas—feeder line construction; Midwestern Engineers, Tulsa, Oklahoma—main line and submerged crossing construction; Pipe Line Construction Corporation, Camp Hill, Pennsylvania—main line and submerged crossing construction; Pittsburgh-Des Moines Steel Company, Pittsburgh, Pennsylvania—aerial crossings and bridge installation of pipe; W. J. Riley, Monroe, Louisiana—residence construction, compressor station sites; N. A. Saigh Company, San Antonio, Texas—main line construction; Ray L. Smith Construction Company, El Dorado Kansas—main line construction; Linwood Smith, Lake Village, Arkansas—bridge crossing levee work; Stearns-Roger Manufacturing Company, Denver, Colorado — compressor, deyhdration, measuring and regulating, and check meter stations; Swinerton-Walberg Company, San Francisco, California—main line construction; O. C. Whitaker Company, Fort Worth, Texas—main line construction; Williams Brothers Corporation, Tulsa, Oklahoma—main line and submerged crossing construction.

Principal Sub-Contractors

J. B. Barbour Trucking Company, Iowa Park, Texas—pipe stringing; J. L. Cox & Company, Raytown, Missouri—pipe stringing; C. Hobson Dunn Company, Dallas, Texas — pipe stringing; Parkhill Truck Company, Tulsa, Oklahoma — pipe stringing; The Pressure Weld Company, Houston—welding; C. S. Seal, Sicily Island, Louisiana—right-of-way clearing; J. R. Vandaveer & Son, Neodesha, Kansas—pipe stringing.

Engineering and Accounting Consultants

Arthur Andersen and Company Houston—consultant in connection with accounting system installation, tax problems and special audits; Brokaw, Dixon and McKee, New York—engineering consultant; Matthews and Kenan, San Antonio, Texas—design of aerial suspension river crossings in Texas and Louisiana; Parkhill-Wade (Henry N. Wade), Los Angeles—consultant of The Stearns-Roger Manufacturing Company in the design of compressor stations and dehydration plant; Starr Thayer, Houston—consultant on pipe coating and cathodic protection.

Engineering and Accounting Advisors

C. H. M. Burnham, chief engineer of Panhandle Eastern Pipe Line Company; John Clark, chief engineer of Hope Natural Gas Company; A. B. C. Dillworth, comptroller of Northern Natural Gas Company; A. L. Forbes, Jr., vice president of El Paso Natural Gas Company; J. L. Foster, general superintendent of Lone Star Gas Company; J. E. Franey, treasurer of El Paso Natural Gas Company; A. D. Greene, chief engineer of United Gas Company; R. T. Powers, superintendent of transmission of Natural Gas Pipe Line Company of America; Lloyd Witter, treasurer of War Emergency Pipe Lines, Inc.; George S. Young, vice president of Columbia Engineering Corporation.

Engineering Services

Huey and Cage, Monroe, Louisiana—survey and mapping of Louisiana, Arkansas, Mississippi, Tennessee and Kentucky; Moody Engineering Company, Pittsburgh, Pennsylvania—inspection of pipe at the mills; Southern Mapping Company, Greensboro, North Carolina—survey and mapping of Texas and West Virginia; Tobin Aerial Survey Company, San Antonio, Texas—aerial mosaic mapping of Texas and Louisiana.

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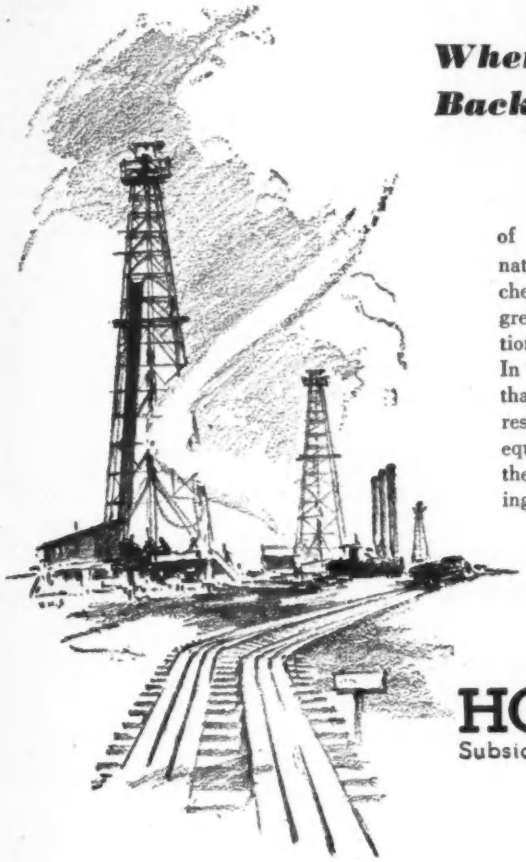

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Thermal Principle Applied To Secondary Oil Recovery

By ANTHONY GIBSON, Staff Writer

APPLICATION of the thermal principle in secondary oil recovery on a commercial scale is scheduled soon in several depleted Mid-Continent pools, following two experiments in Oklahoma which produced interesting results.

The principle is to transfer heat by means of superheated air into a depleted formation through a centrally located input well equipped with a heat exchanger. The radiated heat frees locked gases in the surrounding formation and as they expand they drive underground fluids to nearby producing wells. Thermal action is credited with the ability to liquefy congealed oil in the formation and to set it in motion after the primary energy has been dissipated and to boost the gravity of the oil at the well mouth.

Predicated on results obtained on initial experiments, the technique appears to provide a new method for stripping oil sands and the developer claims it will give results in formations after they have previously been subjected to other secondary recovery methods such as gas repressuring and water flooding.

Specifically called a "thermal system for repressuring dead oil fields," the unit consists of an air compressor of suitable capacity, depending on depth of depleted formation, a horizontal superheater, and a heat exchanger. The heat exchanger is permanently installed in the input well. The input well may be any abandoned well centrally located in a cluster of dead or depleted wells to be reactivated, provided the casing is still in the hole. However, as casing strings in old wells are invariably corroded and even split—and wells to be serviced by the thermal system will, as a rule be many years old—it may be necessary to drill a new input well and equip it with seamless pipe capable of withstanding high pressures. Or the old casing may be pulled and a string of suitable pipe cemented in the old hole.

The unit can service as many depleted or dead wells as are located on a 160-acre lease. While greater recovery and longer life for the project are claimed where the unit operates in an area on which little or no water is to be handled, initial experiments conducted in two completely water-logged fields showed comparatively satisfactory results with surrounding producing wells, some as far away as 1200 feet reacted to the thermal action by producing volumes of gas where no gas had been noted for years, appreciably increasing production and raising the gravity of the oil several degrees.

The first experimental thermal system unit in the Mid-Continent area was installed by E. W. Hartman, its designer in 1942. The pool selected was located north of Bartl[illegible]e in Washington County and had been abandoned and sold to a junk dealer for salvage. The producing formation was 20 feet of Wayside sand at a depth of 600 feet. There were approximately 80 old producers on the lease, 30 of which were located in haphazard fashion on the quarter-section on which the unit was installed.

Before being abandoned the field had been producing for about 25 years, the last 3½ under gas repressurring. Some wells which had not been abandoned were part of a water-flooding project and the quarter-section selected for the experiment was located on the down dip of the structure. The 30 old wells were rated at about four barrels of oil per day, plus 120 barrels of salt water. The operator had selected a truly depleted, water-logged area for his experiment.

Because of wartime restrictions on materials, Hartman was unable to obtain priorities for heat-resisting steels to fabricate the superheater and heat exchanger. Combing the junk yards, he obtained a 160-cubic foot compressor and an assortment of second-hand pipe and erected his first installation.

Early Effects Noted

After viewing the makeshift plant, engineers doubted if the superheater could deliver enough heat through the heat exchanger to warm the formation for a radius in excess of 20 feet. They expressed doubts that the project could produce sufficient oil to provide fuel for the superheater and doubted if enough underground reaction could be induced to produce even small quantities of gas. Since the function of the superheater was designed to provide air heated to 1200 degrees Fahrenheit, it was estimated the burners would require at least 40 barrels of fuel oil per 24 hours to generate the required temperature. Inability to procure bottomhole thermometers and other gauges required to record above and below-ground action of the unit further handicapped the experiment.

But according to the operator's records, thermal reaction was noted in surrounding wells after the unit had been operating 10 days. Hartman reported that after 12 days a well 660 feet away flowed 36 barrels of oil in three hours. After the unit had been operating two weeks, eight other pumping wells within a radius of 1200 feet started to head up and flow and all began to produce considerable gas. In a well 330 feet away, considerable oil showed up around the surface pipe while another dead one 660 feet away produced sufficient gas to roar through a quarter-inch valve and light a 15-foot flare.

Gravity of the oil was boosted from 25 to 32 degrees and approximately 2700 barrels of oil was gained.

Tests also indicated the oil, which was originally produced at a temperature of 60 degrees Fahrenheit, had increased in temperature to 90 degrees. Fuel consumption amounted to a little less than two barrels of oil per 24 hours. The superheater was estimated to have heated the air to 1200 degrees Fahrenheit and to have delivered the air to the heat exchanger at the bottom of the input well at a temperature of 1000 degrees and at the rate of 150 cubic feet per minute. The operator reported that all wells on the quarter-section were definitely affected by the underground thermal action.

After 40 days of operation the project went entirely to water and this is ascribed to the proximity of the water-flooding project where the water head in the input wells was lowered and the water gravitated to the low part of the structure. Sidewall cores taken after

Superheater, left, and air compressor used on an experiment of the thermal system of secondary oil recovery in two dead and abandoned pools in Oklahoma.

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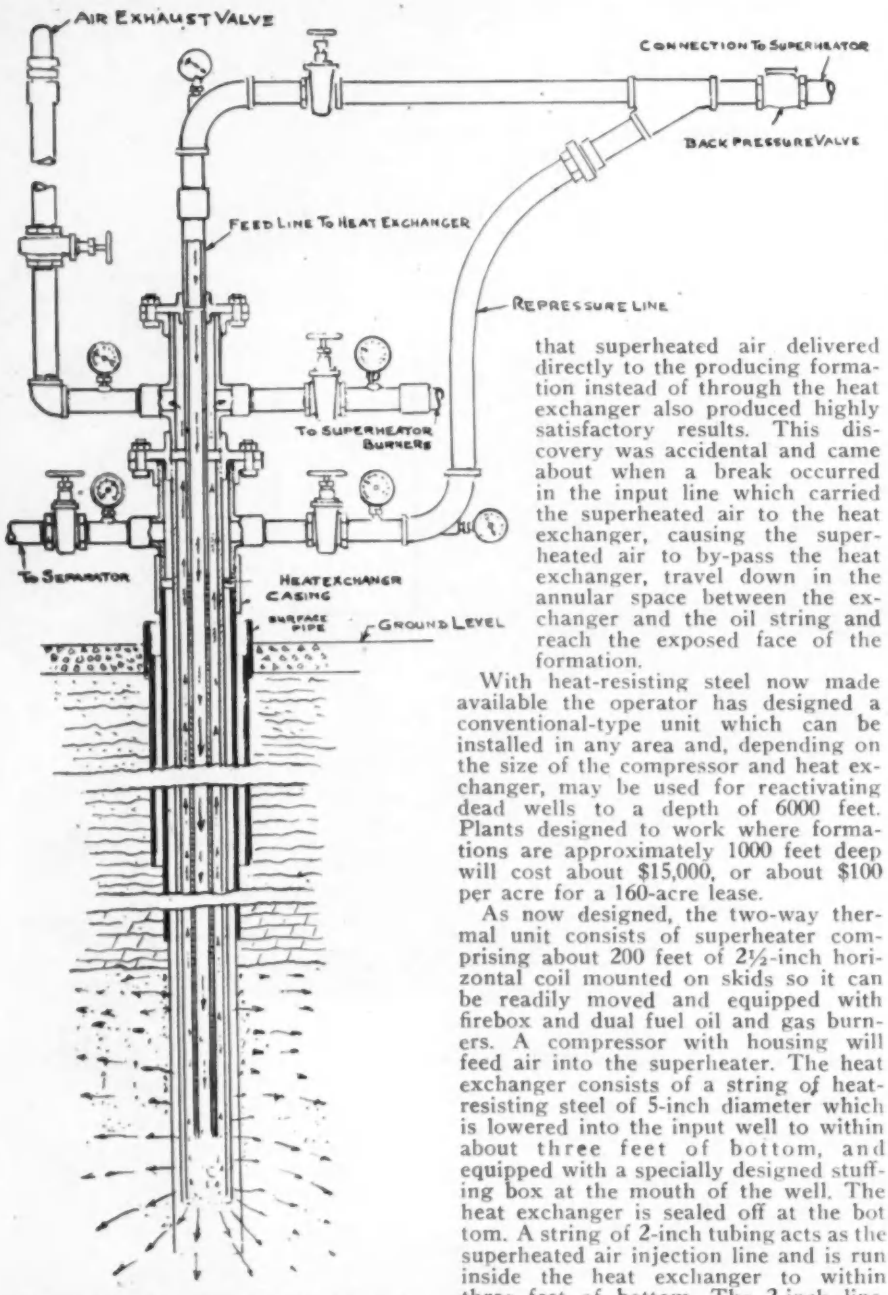

Two-way thermal system heat exchanger with "Christmas tree" connections showing how superheated air is carried through the 2-inch input line to the bottom of the heat exchanger where the heat is transferred to the formation.

the test showed almost complete oil depletion. At the beginning of the operation oil company engineers calculated that the field had been stripped of all but ten percent of recoverable oil and the operator believes that if his project had not been flooded out he could have produced much of the remaining oil.

Dismantling the unit, Hartman moved it to Ardmore to determine thermal underground action on formations carrying heavy, asphaltic-base crudes. This was an area where the producing formation was at 1000 feet and the input well was the center of a five-well pattern, all dead. During the second run the four wells serviced by the input well developed large volumes of gas and some oil was produced before the "junk pile" unit finally gave out and was boarded up. It was during the second run that the operator discovered that superheated air delivered directly to the producing formation instead of through the heat exchanger also produced highly satisfactory results. This discovery was accidental and came about when a break occurred in the input line which carried the superheated air to the heat exchanger, causing the superheated air to by-pass the heat exchanger, travel down in the annular space between the exchanger and the oil string and reach the exposed face of the formation.

With heat-resisting steel now made available the operator has designed a conventional-type unit which can be installed in any area and, depending on the size of the compressor and heat exchanger, may be used for reactivating dead wells to a depth of 6000 feet. Plants designed to work where formations are approximately 1000 feet deep will cost about $15,000, or about $100 per acre for a 160-acre lease.

As now designed, the two-way thermal unit consists of superheater comprising about 200 feet of 2½-inch horizontal coil mounted on skids so it can be readily moved and equipped with firebox and dual fuel oil and gas burners. A compressor with housing will feed air into the superheater. The heat exchanger consists of a string of heat-resisting steel of 5-inch diameter which is lowered into the input well to within about three feet of bottom, and equipped with a specially designed stuffing box at the mouth of the well. The heat exchanger is sealed off at the bottom. A string of 2-inch tubing acts as the superheated air injection line and is run inside the heat exchanger to within three feet of bottom. The 2-inch line, connected directly to the superheater, is bushed to the heat exchanger with a specially designed stuffing box. A V-shape connection is provided from the superheater injection line to the top of the oil string for special repressuring purposes while between both stuffing boxes the heat exchanger is tapped with a 2-inch line which carries away the spent air. A 2-inch line also taps into the top of the oil string to carry away gaseous vapors when the shut-in pressure of the input well increases beyond the safety factor. These vapors may be run through a condenser to produce casing-head gasoline.

To operate the unit, air from the compressor is superheated to approximately 1200 degrees Fahrenheit and passed along the 2-inch input line to the bottom of the heat exchanger. It returns between the annulus of the input line and the heat exchanger to be discharged into the air. Theoretically, the superheated air is designed to hit the bottom of the heat exchanger at approximately 900 degrees Fahrenheit and is discharged at approximately 300 degrees. Part of the spent air is returned to the firebox of the superheater to atomize the fuel oil. The effect produced by the constant radiation of heat transferred from the heat exchanger to the outside formation is to cause expansion and pressure.

The operator estimates that the 900 degrees of heat will cause an expansion of 1700 to 1, setting up an outside pressure building up to approximately 2000 pounds. The pressure first builds up inside the input well and then backs up into the formation, driving the gas and oil toward the producing wells.

Superheated air is injected into the input well at the rate of 150 cubic feet a minute. Where formations consist of unconsolidated sands and channelling is suspected, superheated air is applied directly to the exposed formation by shutting the valve on the injection line and opening the valve on the repressuring line. To apply superheated air pressure to the formation the air is sent down the input well in the annular space between the oil string and the heat exchanger at the rate of approximately 700 cubic feet of air per minute at a pressure of 600 pounds per square inch. The air is superheated to a temperature of from 300 to 1000 degrees Fahrenheit.

The operator claims it will require only three men to operate a thermal unit and recovery costs will not exceed ten cents per barrel. The system is designed especially to assist the small operator who cannot afford to install more expensive secondary recovery systems. The operator spent thousands of dollars in initial experiments and believes that as presently designed the unit can recover as high as 80 per cent of residual oil left in the ground after other secondary recovery methods have stripped the oil to the limit of their capacities.

Input well on abandoned Oklahoma oil lease showing 2-inch input line used to inject superheated air into a heat exchanger at the bottom of the well, and line, left, where spent air was vented. Standing beside installation, assembled from junk pipe and parts is E. W. Hartman, designer and patentee.

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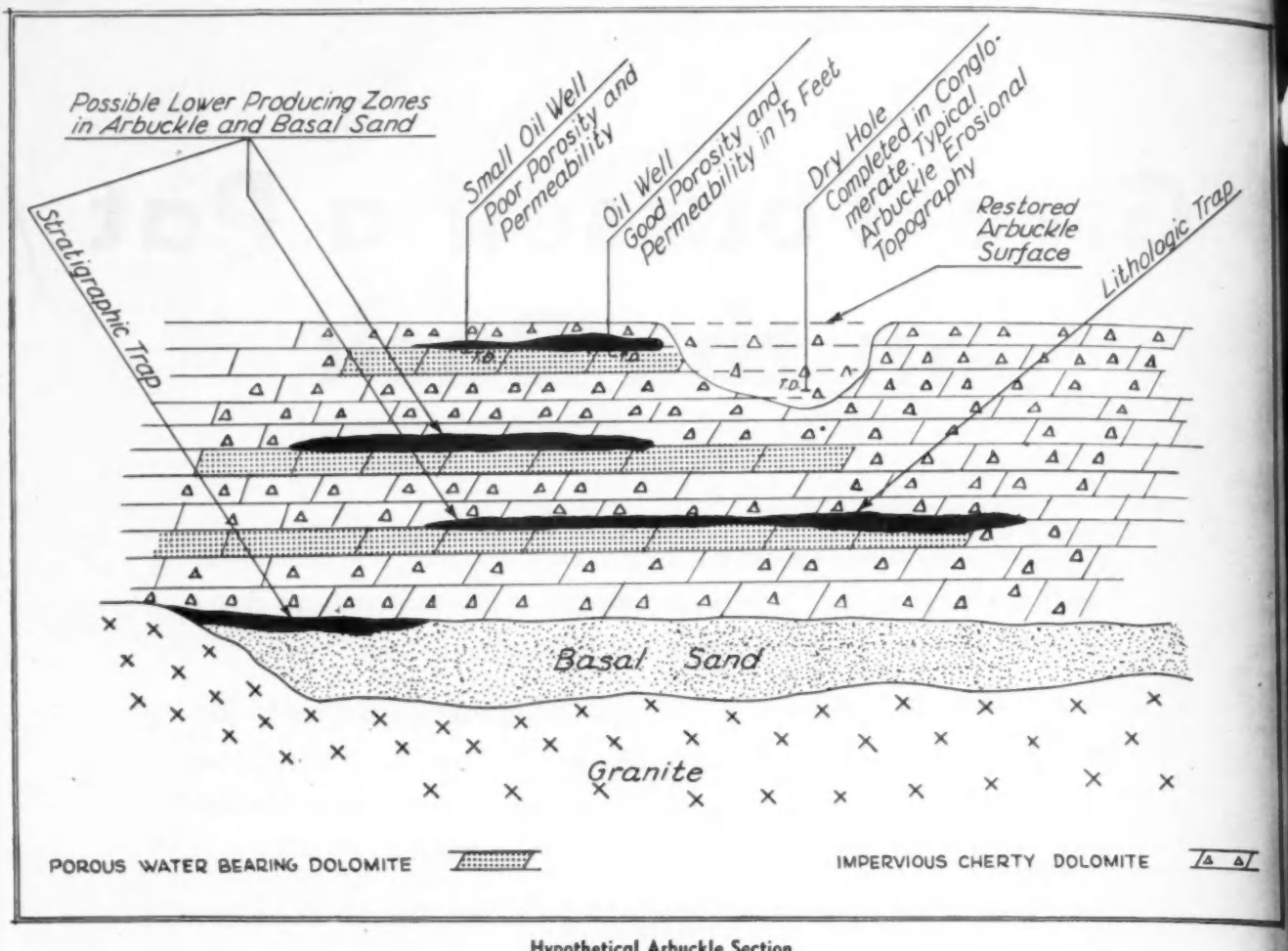
Possible Lower Producing Zones in Arbuckle and Basal Sand
Small Oil Well Poor Porosity and Permeability
Oil Well Good Porosity and Permeability in 15 Feet
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TD
Basal Sand
Granite
POROUS WATER BEARING DOLOMITE
IMPERVIOUS CHERTY DOLOMITE

Hypothetical Arbuckle Section

Kansas Operators Neglect Deep Arbuckle

By J. T. PADDLEFORD, Geological Engineer

DRILLING operations in Kansas during 1943-44, although resulting in the discovery of more than a score of small oil and gas pools has, from the standpoint of additional reserves developed, been disappointing and marked by a large number of failures. While every section in oil producing territory experiences its cycle of failures, followed as a rule by a period of lucrative new discoveries, the writer believes that in Kansas at least the number of failures could very well be smaller if certain set drilling principles were discarded and some pioneering spirit injected into future drilling operations.

"Follow the Leader"

Most operators more or less follow the leader in drilling practices and well completions. For some reason it has been the custom in Kansas drilling to penetrate the Arbuckle zone only a few feet, and if no oil or gas is encountered, to abandon the hole as dry. This practice, common among Kansas operators both large and small is very short-sighted and as a result much new production has been passed up and the areas will have to be re-drilled in the future.

The Arbuckle dolomite is a marine bed of Ordovician age and underlies the whole state of Kansas. Its thickness varies from locality to locality dependent on the position of the granite below it and dependent on the amount of local weathering it was subject to when the bed was exposed on the surface. The lithology of the Arbuckle is similar to many other lime beds that have been fully penetrated, i.e., Topeka and Lansing of Pennsylvanian age. Porous and permeable zones within the bed are heterogenously located in the section and for this reason an arbitrary penetration depth cannot be established as the point below which oil accumulation cannot be expected.

Operators' follow-the-leader practice of abandoning dry holes in upper Arbuckle is short-sighted and is sure to necessitate re-drilling later of many potentially rich fields

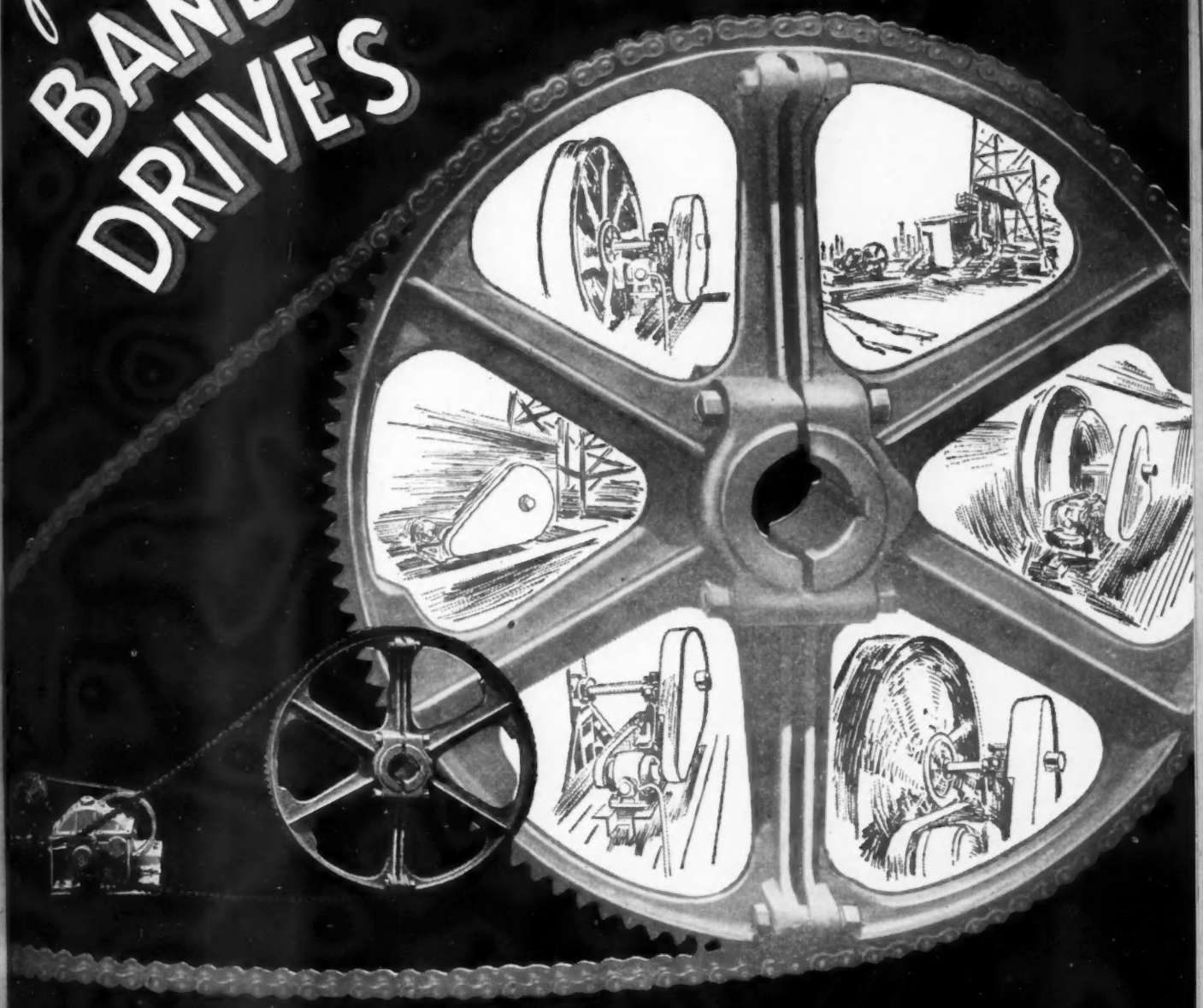
Lower Producing Horizons

The unconformity which occurs at the base of the Pennsylvanian has given many headaches to Kansas operators. When the Arbuckle is found below the Pennsylvanian with all intervening sections missing, the Arbuckle surface is most erratic and evidently subject to severe weathering. These erosional holes or channels are filled with debris of Pennsylvanian and Ordovician origin. This condition is quite prevalent even in producing Arbuckle fields from offset to offset.

If the assumption is correct that there is possible lower producing horizons in the Arbuckle, the presence of conglomerate on the top of the Arbuckle does

■ CONTINUED ON PAGE 178

Pacific BANDWHEEL DRIVES



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Practical Design Given for Repressuring Surface Systems

ASSUMING core analyses or other guiding data are known on a property, the primary factor which should be considered in surface-system design is the volume of air or gas which must be handled through the life of a project, and the surface pressure which will be required for injection.

Selection of the proper daily input volume is of course important and is best accomplished by experimentation. If gas or air is injected too slowly, oil will not be moved in the sand, injected gas or air will exhaust its driving energy by gradually dispersing through the sand, and the economic picture will be unbalanced. Injection of too much gas or air may result in channeling or by-passing to one or more of the producing wells, causing only a temporary increase in production and proving to be economically worthless, as air or gas injected thereafter merely cycles through the established channel and moves a negligible quantity of oil. Results of either operating extreme are usually evidenced after a short period of injection.

It should be kept in mind that (1) there is a definite limit to the amount of oil which may be driven from an oil sand due to its physical composition, and (2) there is a narrow range of injection volumes which will provide maximum efficient driving action. Injection volume to be used depends upon the individual project and should be regulated to that volume which experimentation shows will recover the most oil. Many successful projects are started at low volumes, say 250 cubic feet per foot of vertical sand per day, and gradually increased over a 12 to 18 month time period until the proper and maximum rate is determined by production reaction.

Determining Injection Rates

Some engineers are of the opinion that soft, porous sands should have low injection rates initially while tight sands, such as those found in the eastern states, should have high initial injection rates. However this may be, there are many successful projects in operation today in both "soft" and "hard" sands which have determined injecting rates by gradually increasing volumes from a low value and are indicating that the highest possible return will be obtained. The procedure to be followed is strongly affected by economic aspects of the problem and relative scarceness or abundance of precedent data on the sand. Nationwide injection volume averages between 500 and 2000 cubic feet per day per foot of sand in each input well.

The ultimate volume of gas or air which must be injected is exceedingly important, especially to those operators who do not have sufficient gas supply from their properties for operation of a project. Requirements of projects started relatively early in a pool's life seldom exceed by one half the volume of gas produced from the property, while projects in operation in the older fields require nearly complete outside source of injection media.

Gas-oil ratios, or cubic feet of gas produced per barrel of oil produced, increases as repressuring goes on, the increase averaging generally under 250 cubic feet per barrel per year. This figure could be applied to present production of the property to be repressured and increased over estimated economic life of the project. By so doing an approximate ratio is determined, which gives approximate volume requirements when applied to estimated production data. A reasonable prediction may be made which thereby forms the initial basis for the decision of whether gas may be purchased and used on a depleted property, or whether a gas-air mixture or air is required.

The practice followed by many operators is to set a portable compressor unit for determination of volume and pressure which will be required. By such economically sound experimentation expected recoveries are also defined.

Pilot Plant Operation

Such experimentation, or pilot plant operation, is definitely recommended as good policy and sound procedure to any operator either large or small. Extensive field test data and laboratory work should be correlated during this period to insure value of estimates made from information obtained.

Injection pressures will, of course, vary according to volumes introduced, higher volumes requiring more pressure, other factors being equal. Injection pressures of depleted pools are usually low, and surface pressures seldom exceed static bottom hole pressures by 100 pounds, usually averaging about one third that value. If exact data are not determined by experimentation, permeability offers a guidance. It is impossible to mathematically define either volume or pressure required for repressuring exactly, however, formulas have been derived and liberally amplified by many engineers which offer useful limitations.

After daily and total volumes and pressures are known, mechanical design of surface equipment should be made.

Surface lines must be designed to meet volume and pressure requirements. Many formulas have been developed for computation of gas flow through pipe lines, however Weymouth's formula seems to agree closely to actual transmission by measurement and is therefore extensively used.

Weymouth's formula is:

$$Q = 15{,}322.47 \left(\frac{(P_1^2 - P_2^2)\, d^{5\text{-}1/3}}{GTL} \right)^{1/2}$$

Where

Q = Flow in cubic feet per day at 60 degrees F. and 14.7 pounds absolute pressure.

P_1 = Initial pressure in pounds per square inch absolute.

P_2 = Final pressure in pounds per square inch absolute.

d = Pipe diameter in inches.

G = Specific gravity of gas (air=1.00).

L = Length of line in miles.

T = Absolute temperature of gas.

This formula may be used for calculation of surface line size. In addition pressure losses due to fittings should be considered. A 2-inch globe valve has resistance to flow equal to 7 feet of straight 2-inch line, while 2-inch tees and elbows offer resistance equal to 5 feet of additional line. Line size requirements are calculated with this formula.

Systems of Distributions

Two general systems of distribution lines are used. The first, and one most generally used in that it offers lower initial investment cost, is the loop system, with a single line being connected to all input wells. This type system is best when operating conditions are fairly uniform and no large variations of input pressures exist in the project. In the second system a line is run from the compressor to each well.

In addition to the normal line development the distribution system design should include consideration of mechanical installations necessary to minimize trouble encountered by formation of hydrates and from freezing during cold weather. Installation of line heaters, dehydrators, alcohol drips, line insulation or burial may be required.

Compressor capacity required is also a definitely calculable item. Capacity, when referred to a compressor, means the amount of gas handled at an intake pressure of 14.73 pounds per square inch and intake temperature of 60 degrees F. Nominal displacement of a compressor is the space displaced by the compressor piston, making no allowance for clearance or re-expansion. Volumetric displacement of a compressor is obtained by multiplying nominal displacement by volumetric efficiency.

Volumetric displacement in thousands of cubic feet per 24 hours for a double acting compressor is:

$$D_v = \frac{2\pi \times 24 \times 60}{4 \times 1000 \times 1728} d^2 LNE$$
$$= 0.001309\, d^2 LNE$$

Where

D_v = Volumetric displacement in thousands of cubic feet per 24 hours.

d = Diameter of low pressure cylinder in inches

L = Low pressure of cylinder stroke in inches

N = Revolutions per minute

E = Volumetric efficiency of the low pressure cylinder (decimal fraction).

Compressor capacity in standard cubic feet is then:

$$C = \frac{D_v (P_g + P_a)}{14.73}$$

C = Capacity in standard cubic feet

D_v = Volumetric displacement

P_g = Intake pressure in lbs./sq. in. gauge

P_a = Barometric pressure lbs./sq. in.

Air compressor capacity with atmospheric intake pressure is:

$$C = \frac{D_v \times 35.3\, P_a}{T}$$

These formulae do not consider other

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constants and variables which need not be considered in this generalized article. Horsepower required for driving compressor is then determined.

In order that injected volumes may be accurately measured, an orifice meter should be set on the discharge line. Gas measurement by an orifice meter consists of (1) measuring the differential pressure across an orifice plate installed in the line, and (2) static pressure. The basis volume formula is:

$Q = C\sqrt{h \times p}$

Where

Q = Rate of flow at base conditions (cubic feet per hour)

C = Basic orifice coefficient

h = Differential pressure in inches of water

p = Static pressure in pounds per square inch absolute.

At least one meter is set on a project, and sometimes one for each sand in every input well. The number used depends upon nature of the project and range of variables encountered. Good records are definitely essential to the successful operation of any project.

Air or Gas?

The decision of whether to use air or gas or a combination of both is very important. Air, of course, is not used where gas is available since gas is preferrable over air. As a rule air will perform satisfactorily and possesses the quality of not being soluble in oil and therefore is a better driving media than gas.

Use of air invites many operating difficulties such as equipment corrosion, oxidation of the oil to form insoluble sand plugging resins, formation of emulsions, paraffin, increasing oil viscosity and reduction of gravity, dilution of gas for fuel and compression danger. These of course may be controlled by use of cement-lined pipe and alloy steels, installation of explosion chambers, emulsion treatment, usual paraffin treatment, etc. However lifting costs thereby make the use of air impossible in some cases. Action of air on viscosity and gravity of the oil cannot be controlled. If recovery justifies its use, air is perfectly satisfactory for repressuring.

Nationwide averages show an input volume ranging from 100 to 30,000 cubic feet injected per barrel of oil produced at input pressures ranging from 10 to approximately 800 pounds. Reported recoveries range from 100 to nearly 5000 barrels per acre.

Most repressuring projects do not have the extensive drilling and development found in water flood projects. Recovery does not justify it. As a rule, though some new wells are drilled, either to complete a pattern or for core purposes.

Original development is usually of satisfactory spacing for repressuring operations. Producing wells outnumber input wells in ratio of 1 to 2 up to 1 to 17 in known cases. Spacing required, and used, usually is one which conforms to property boundaries, with one input well serving a geometric pattern of producing wells. Acres per input well depends upon previous development, sand character and depth, etc., and usually averages between 20 and 60. If existing spacing of wells permit, each producing well should have pressure acting upon it from at least two (opposite) directions.

Deeper Arbuckle Drilling Advised

• CONTINUED FROM PAGE 174

not waive the probability of production lower in the Arbuckle. Although it is the general practice to correlate wells on the top of the Arbuckle and if a low Arbuckle top is found due to eroded topography, it still is possible to believe that the overall thickness of the Arbuckle will remain constant. As a result, the base of the Arbuckle and top of the formation underlying the Arbuckle will be as high as surrounding production. A glance at Figure 1 shows this possibility.

The reason for eroded Arbuckle topography can easily be explained by the differential weathering during Arbuckle emergence before Pennsylvanian deposition.

A hole full of water found at a shallow depth in the Arbuckle does not justify the thought that the entire section would be water bearing. If the Arbuckle was found to be reasonably high on structure and had water in the top few feet, it is most likely that an impervious zone would be found below the water and that lower porous zones could contain an oil accumulation.

If the Arbuckle was found to be low structurally, it still is plausible to assume that a lithologic trap could be encountered as shown in Figure 1.

The reason for lithologic traps may be explained as follows: Secondary infiltration of magnesium, calcium, or silica waters into a porous bed causes secondary depositions and thus seals off any possible migration of oil to a higher level. This would more or less explain the chance of finding lithologic traps for oil in the down dip side of a bed.

If the above contention is true, it might be said that oil can be found in any sedimentary horizon at any position if the drill is fortunate enough to hit these spots. As a result, the Arbuckle and lower beds offer a tremendous new possibility for future oil.

Lithology Important

In view of the growing demand for new oil, new ideas and new emphasis must be placed on known facts. The scarcity of type structures and type traps must cause operators to investigate other type traps that have not received proper recognition.

Study of the lithology of various formations must be given strong emphasis. Discarding worn-out theories must be the vogue for future exploration.

In the last few years the recognition of the stratigraphic traps has yielded enormous new oil wealth to the country. Now the recognition of another type trap must be emphasized—the lithologic trap. This type trap is not as dependent on favorable structural features as are other types.

Heretofore, the presence of water in the Arbuckle at a shallow penetration predicated the thought that the entire section of Arbuckle would be water bearing. This thought is erroneous due to erratic lithologic characteristics being present.

Dense impervious zones interspaced with porous permeable zones certainly show the possibility of not being able to establish a definite water table. This fact also shows that there is the probability of isolated water horizons being found above oil horizons.

The Lansing section of Kansas proves this point. There is in most of the Kansas City pools some four zones of porosity where oil is found, namely, the 30-foot, 60-foot, 90-foot, 120-foot and in some instances the 220-foot zones. Water in some instances is found in the zones of porosity above the oil zone. Surely, if this is a fact, the Arbuckle holds the same potentiality.

In a certain well in the Zenith pool the entire Viola section was drilled with cable tools and some six pay zones were found with water below and above each zone.

A few companies have experimented with insoluable residue analysis of the Arbuckle section. The identification of a producing zone of the Arbuckle by recognition of characteristics with insoluable residues is an attempt in the right direction but does not prove anything unless the entire section is drilled and the correlation of a great number of holes is made.

There is no reason not to believe that the Arbuckle is underlain with Basal sand throughout most of Kansas. There are at present a few Basal sand pools in Kansas, namely, Phillipsburg, Penny Wann, etc.

The type trap in this horizon would be the pinch out or stratigraphic trap. There is also the possibility of finding production in the erosional phase of a granite which would be a granite wash.

Conclusion

1. All holes should be drilled to the granite.

2. The lithology of all horizons should be given great consideration.

3. The additional cost of drilling would be well recompensed in a short time.

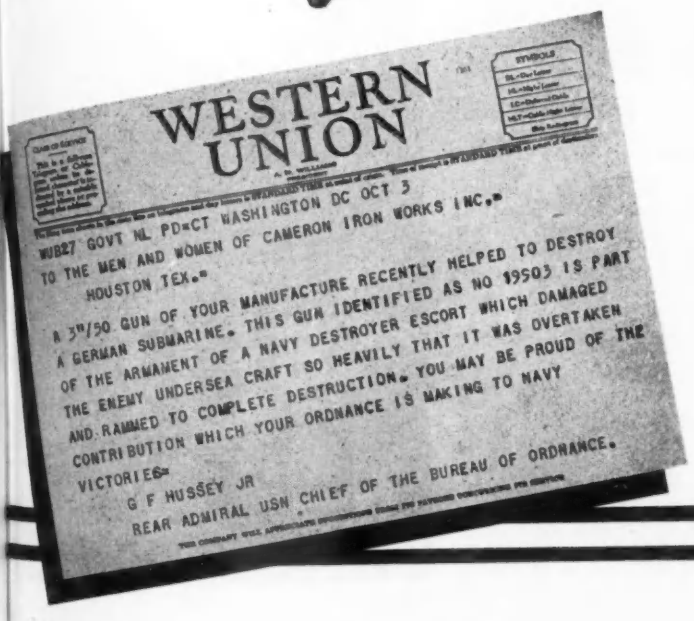
4. Not so much emphasis should be placed on a low Arbuckle top due to a thick conglomerate section. The top of the Arbuckle on this type hole should not be used as a point of correlation. In view of the relatively shallow depth that the granite can be found in the greater part of Kansas, great new oil reserves can be uncovered at a comparative low cost.

Supreme Court Ruling Involves Texas Oil Land

The Texas Supreme Court has ruled again on the old question of acknowledgment of married women where the conveyance of real property is involved. The new decision, reaffirming the old statute, was handed down last week in the case styled Humble Oil & Refining Company v. Clara May Downey.

In effect the court held that where a married woman conveys property, acknowledgment of this conveyance must be taken privately; that is, she must be examined by a notary apart from her husband to be sure that she is a willing party in the sale of community property. The decision involved 76 acres of producing oil land in the Webster field, Harris County, Texas, on which there are now three producing oil wells.

C. R. GALLAGHER and H. H. Van Akin, president and production superintendent, respectively, of the Permian Oil Corporation, West Texas producing concern that has been acquired by the Stanolind Oil & Gas Company, have formed the Midway Oil Company with headquarters at Lubbock, Texas.



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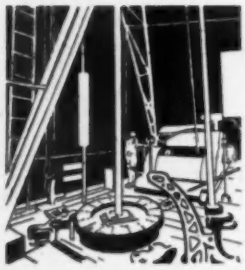

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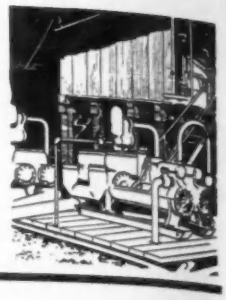
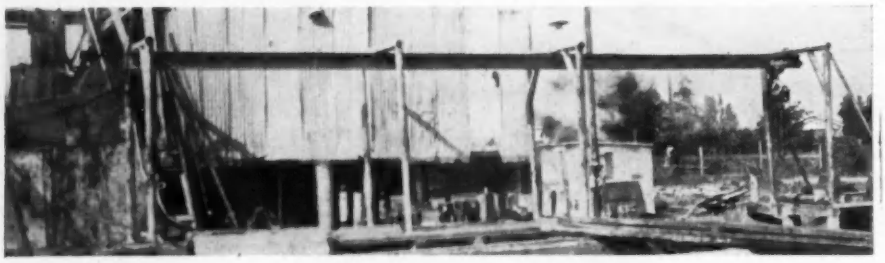


Trolley and Track Speed Rig Equipment Transfer



This all-welded steel track, extending from floor to loading dock, enables one man with chain hoist to move equipment which otherwise would call entire crew from specialized tasks.

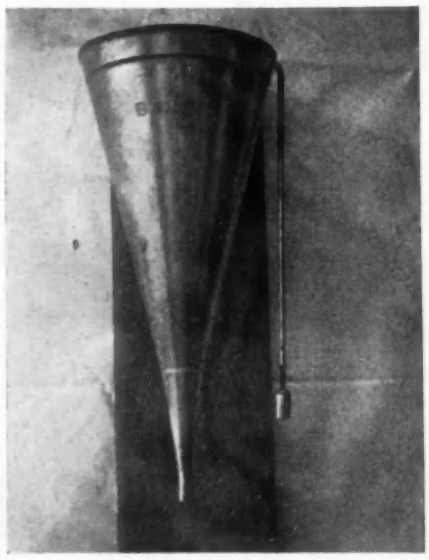
When rig setup makes it impracticable to bring heavy equipment up for direct lifting by derrick hoisting units, the construction of an overhead track with trolley and chain hoist saves time and manpower by permitting one man to unload from the truck and transfer to the working floor units which otherwise would require several men, and also possibly make demands on the rig when it could be otherwise employed.

EQUIPMENT HANDLING

The I-beam forming the track for the hoist is suspended by welding it to the under side of the pipe members spanning the two upright posts of each bent. In this way a clear span is insured, with ample clearance between posts to permit handling any unit which may be needed.

Relatively light posts and cross members can be used for this structure, by welding braces of pipe between post and transverse member, bringing support close to the beam weld.

Unique Pendulum Times Mud Viscosity Tests



Built-in pendulum replaces hard-to-find watches for timing flow of mud through standard funnel.

Due to the scarcity of stop watches, and even to watches with second hands which permit accurate estimation of elapsed time, for use in the field in determining mud viscosity readings in seconds with the Marsh funnel, a novel method has been evolved whereby these readings may be taken with the use of a simple pendulum.

VISCOSITY TESTING

The pendulum consists of a piece of 3/16-inch brass welding rod curved at one end to fit the viscosity funnel in the rim of which is filed a half-round notch to reduce friction to a minimum. The pendulum is threaded to provide adjustment of a weight made of ½-inch round brass stock, ¾-inch long in this case, and fitted with a locknut to maintain adjustment. It was found in this case a pendulum with an adjustment of from 11 to 12 inches worked very well, the exact length for an oscillation period of one second being determined empirically.

This arrangement operates satisfactorily in the field, and in bad weather it may be enclosed, togetehr with the funnel, in a box to keep wind, etc. from disturbing oscillations of the pendulum.

Counterweight Regulates Escape Device Descent

As a precaution against possibility of serious injury befalling the derrickman in the infrequent but critical times when he must take to his escape carriage or harness and ride down a guy line, one company provides a counterweight that prevents too rapid a descent, thus assuring his safety as he nears the ground. A 3-foot length of 11¾-inch casing was fashioned into a bucket, equipped with a bail and attached to a trolley on another nearby guy line. The bucket, filled with scrap iron to bring the total weight of the assembly, including the light wire line extending up to the small sheave at the derrick runaround, to something less than the weight of the man who will be working in the derrick. Inexpensive to rig up, the counterweight will do much to eliminate possible cause of injury and will dispel fear in the mind of the derrick man that he might be unable to

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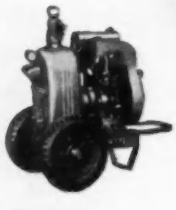

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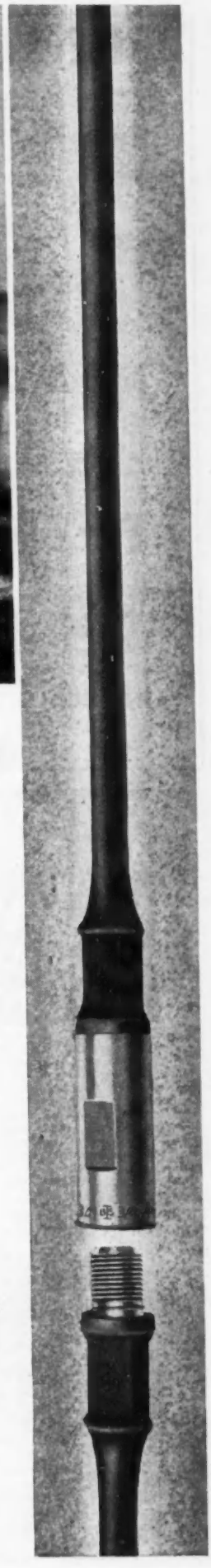

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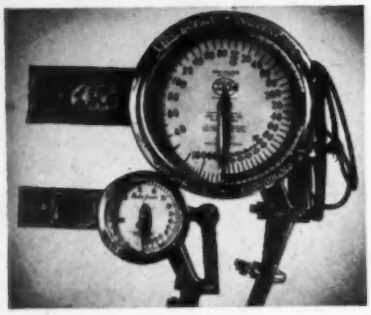

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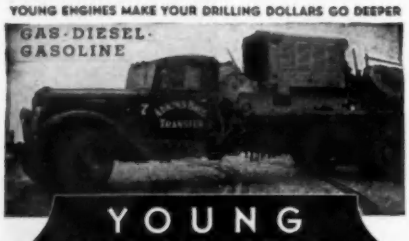

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escape safely should a blow-out occur.

In addition to the line brake usually attached to the escape device, a light manila line, one end attached to the trolley and its length laid conspicuously along the ground also will serve to provide additional safety. Any man who reaches the line will be able to further check the speed of descent of the derrick man as he slides down the guy line.

Supplementary Manifold Centers Rig Floor Control

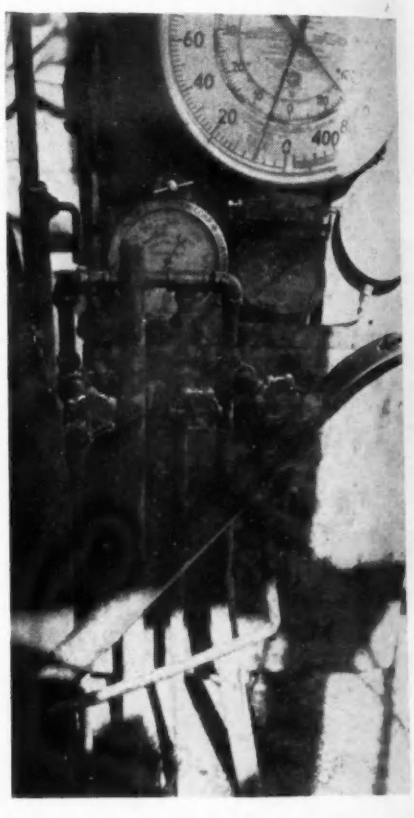
Consolidation or unitization of control facilities on the rig floor speeds operations and, in these days of untrained crews, puts all controls under the hand and eye of the driller. One instance of such consolidation is shown in the combination of water lines used in expediting floor tasks into the single compact manifold mounted conveniently close to the driller's stand.

DRILLING CONTROLS

The multi-purpose stand shown consists of an upright 4-foot long, 1¼-inch supply line which is brought up through the floor beside the drawworks brake and which is flanked by three other valve-equipped smaller lines, the latter being connected into the larger standpipe. The ½-inch outlet and valve on the left side of the larger line is used in controlling the amount of water delivered to the chamber of the water-cooled brake in the drawworks. The pipe second from the right side is the line going over to the hydromatic brake, and by barely cracking the convenient valve, the driller can regulate to any desired size the trickle of water necessary for maintaining maximum efficient operation of the brake.

The line on the far right is a nipple extending downward 18 inches to which is attached a common rubber hose, the latter leading over to a fitting near the top of the conductor pipe just below the rotary table. Water from this line is used to wash the drill pipe as it emerges from the well on coming out of the hole. Advantages of this system are obvious. The driller is able closely to regulate with merely a twist of the conveniently located valve the amount of water necessary to strip the drill pipe of mud. It also eliminates the dangerous practice of having water and mud sprayed over the floor and table, creating a dangerous personnel hazard as is the case when the pipe is washed down with a hose from the derrick floor. Also mud is salvaged that otherwise would be washed into the cellar and sub-flooring—mud which is thus washed off being carried on out into the mud ditch for conditioning and re-use.

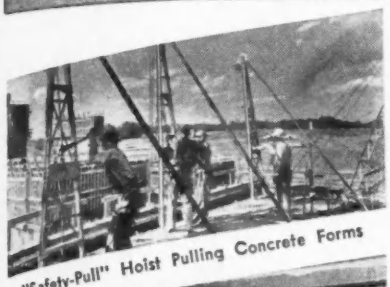
In addition to the three lines shown in this set-up, the company has installed on some rigs still another line connected into this manifold. This line, similar to that used in washing the drill pipe, extends over to and into a fitting near the top of the rat-hole pipe, and is used to wash the kelly each time it is withdrawn from the rat-hole. In this instance, also, the fittings are below the derrick floor, further reducing the danger of slipping and injury to the floor crew, at the same time insuring a clean kelly for smooth operation in the rotary table bushing.



Mounted just ahead of the gauges and indicators, this manifold gives driller full control.

Rigidity of the manifold is obtained by bringing each of the lines through a steel I-beam member of the drawworks base. Unions just above this floor member allow the manifold lines to be broken down, and the drill pipe wash

COFFING HOISTS



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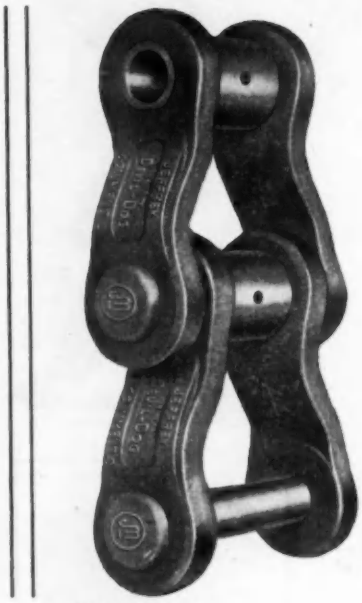

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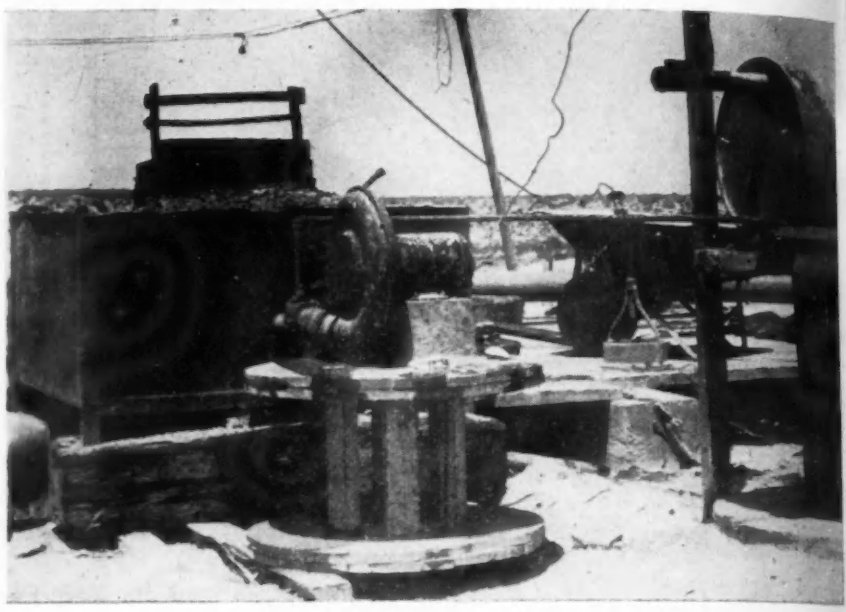
line is of course also removed, whenever the rig is disassembled for moving. The convenient, unitized assembly has contibuted greatly toward increasing the operating efficiency of the drilling rigs of the company.

Discarded Line Spools Serve as Platforms

Such stands are easily handled onto the truck for moving, and may even do double duty by serving for line storage between wells, without affecting their usefulness while actual drilling is being carried on.

If given an occasional coat of paint, the reels will serve longer than most rough-lumber platforms, and in addition insure uniformity.



Blocked to obtain height adjustment, these old spools take the place of special platforms and combine strength with lightness and the added advantage of storage use between the wells.

AUXILIARY EQUIPMENT

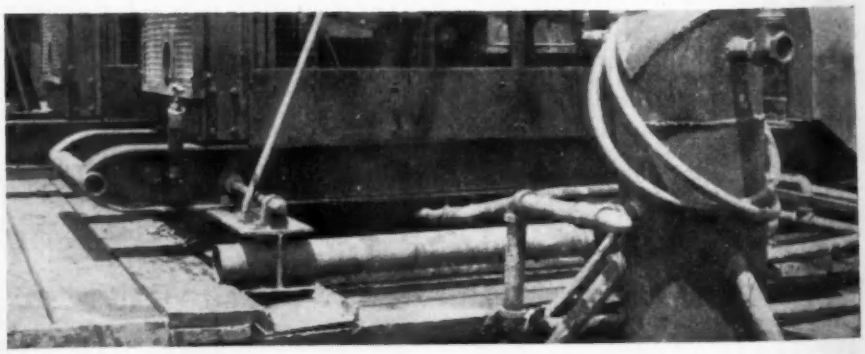
Discarded wire-line spools may be utilized by the driller as supports for equipment which requires a fairly rigid foundation, but for which it would be too much trouble to build special platforms. One cable-tool driller found that a sand-line spool, with a pair of 2 x 6-inch supports to level up the ground and keep the reel from rotting, brought the top of the spool to just the right height for the blower on the tool-dressing forge unit, necessitating only a short, direct air line between blower and tuyere.

A second spool, originally carrying drilling cable, proved to be just the right height for supporting the fuel-oil drum so that the desired gravity head could be maintained on the line to the burner.

Extra Steel Channel Speeds Unit Set-up

RIGGING-UP ACCESSORY

To provide a mounting on which the drilling engines may be adjusted laterally without interfering with the supporting structure, one contractor lays a pair of wide, shallow steel channels where the sub-base or transverse skid member of the engine mounting normally rests. These channels are so aligned that the engines may be slid into place, and then anchored so that the adjustment feature between the longitudinal engine skid and the transverse member may be fully utilized for applying proper tension to the drive between jack shaft and transmission.



Levelling the shallow channels so that the engine skids may be slid directly into position lightens the task of foundation preparation and adds to solidarity of power unit setting.

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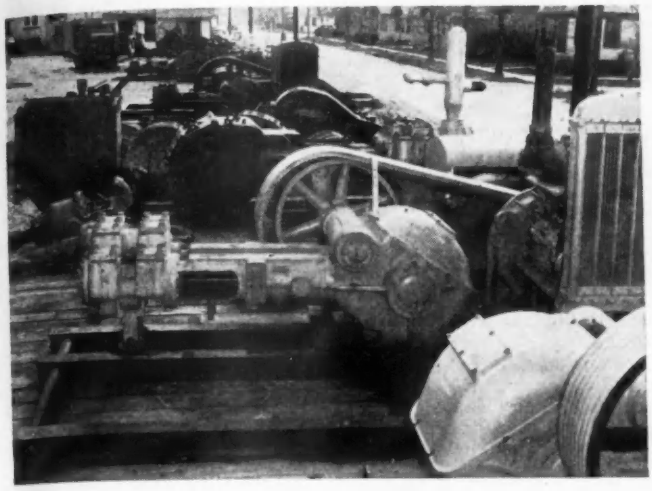

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Some of the many items available for rent are shown in the accompanying picture, ready for immediate use.

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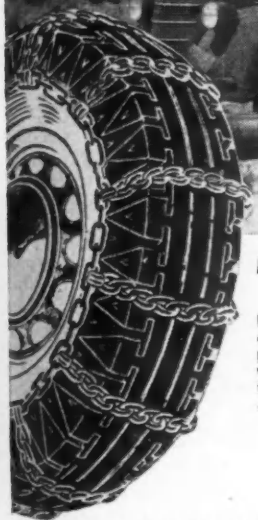

Be sure to specify Taylor-Made Chains when purchasing from your local Distributor

Long use in the hardest continuous duties of oil work demonstrate conclusively the *dependability* of T-M Chains for smooth, continuous and *secure* performance. T-M High Test Steel Chain (shown to right) is in wide service where chain of unusual tensile strength is required. There's a T-M Chain for every service of lifting, binding, pulling, transportation—and protection. Ask your Distributor.

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"Individual" Slide Rules Solve Many Varied Problems for Engineer

As a ready reckoner and a short cut to both simple and complex problems the slide rule is an engineer's standby. There are many slide rules on the market developed by mathematicians and in general use. There are also a number of "individual" rules perfected by individual engineers to solve specific problems and three of these were recently described at an Engineers Club meeting in Tulsa. The inventors and owners of the rules are H. F. Brindel and D. O. Barrett of the Gulf Oil Corporation, and Theodore R. Aude of the Stanolind Pipe Line Company, Tulsa.

About 20 years ago Brindel, whose work included the calculation of capacities of various gas lines, devised a simple slide rule based on a formula developed by F. H. Oliphant and published in "Production of Natural Gas in 1900" by the United States Geological Survey. At the time there was no handy means of calculating capacities other than a series of tables which did not take care of pressures below atmosphere. Later, in 1929, when the formula proposed by Thomas R. Weymouth in transactions ASME, Vol. 34, 192, page 196, was accepted as being more nearly accurate for the flow of gas in pipe lines, Brindel devised a second rule which has been in use by the Gulf organization since. This rule covers a range from 29 inches of vacuum to 900 pounds gauge pressure, and a delivery between one thousand and ten million cubic feet of gas per day. By knowing five of the constants necessary to calculate the line including the upstream pressure, downstream pressure, length of line, gravity of the gas and internal diameter, the sixth or carrying capacity can be readily determined through Brindel's rule. The rule is also arranged so that equivalent lengths and equivalent diameters can be read directly so as to calculate lines of various diameters in the same system and the capacity of the loop lines. By following the simple instructions given on the back of the rule, it has been found that field men without technical training have been able to successfully solve their problems.

Aude devised a "hydraulic slide rule" through which by a single setting of the rule for a given pressure and length of line, the capacity in barrels per hour or barrels per day of the average mid-continent crude oil may be read directly for any size of pipe line from 2 to 29 inches inside diameter. A viscosity and correction scale is provided so that capacity for any fluid from gasoline to very viscous crudes may be determined. The rule may also be used to determine the pressure necessary to pump a given quantity of crude through a line of a given size, or to determine the size of line required to handle a given quantity of crude at a given pressure. All the above applies to the face of the rule which is designed for solution of problems in "turbulent" flow which is the most prevalent type of flow in pipe lines. By reversing slide, problems in "streamline" or "viscous" flow may be solved. With the slide reversed it is also possible to find the "Reynolds Number" with one setting. The units used are the common pipe line units; i.e. pressure in pounds per square inch, length of line in miles, gravity in degrees API, viscosity in Saybolt Universal seconds, pipe diameter in inches, and capacity in barrels of 42 gallons per hour, or per day. A convenient scale is provided for converting feet of head (pounds per square inch) for oil of any gravity. On the back of the rule are tables for converting viscosity in centistokes to Saybolt seconds, and specify gravity to degrees API. For problems involving multiple lines of different diameters the rule may be used to find the diameter of a single line having the same capacity.

The "Horspowrule" and "Gaspowrule" rules were designed by Barrett. They are inexpensive cardboard and metal rules, as are the others already described. The "Horspowrule" was designed to determine the brake horse power engine on the test block. With the known data the rule can be properly set and the brake horse power of an engine being tested read directly on the rule. Prior to the use of the rule, as many different answers were obtained as were men computing the brake horse power, but with the rule the same answer results regardless of whether or not the operator knows the principle. The "Gaspowrule" was designed to determine the rated horse power of gas and gasoline engines of known bore and stroke at various speeds.

Fullerton, O. C. Field Companies to Combine

Fullerton Oil Company and O. C. Field Gasoline Corporation, both of California, have announced a plan by which they will merge under the ownership of Fullerton Oil Company.

Assets of the Field corporation will be transferred to the Fullerton company in exchange for 140,740 shares of Fullerton's authorized but unissued stock. The Field corporation will dissolve and distribute the Fullerton stock, which will then be its only asset, to its shareholders at the rate of 8.79625 shares of Fullerton stock for each share of Field stock. Since 600,000 shares of Fullerton stock are now issued, the present Fullerton stockholders will own 81 percent, and the present Field stockholders 19 percent, of the total stock which will be outstanding under the plan.

The combined operations will increase Fullerton's crude oil production to approximately 6000 barrels daily, at present production rates.

Tankship Firm Is Paid For Torpedoed Vessel

Keystone Tankship Corporation, Philadelphia, will be paid $2,776,803.69 by the government to compensate for the loss of its 11,335 gross tons tanker "Seakay" while in war service, the War Shipping Administration announced.

The "Seakay," built in 1939 by Sun Shipbuilding and Dry Dock Company, at Chester, Pennsylvania, was set afire and sank in the mid-Atlantic several months ago by an enemy torpedo.

Thompson Sees Greater Possibilities for Gas

Predicting an increasingly bright future for natural gas in Texas, Colonel Ernest O. Thompson, of the Railroad Commission of Texas, urged a closer study to conserve this resource, in a speech November 1 at Longview, Texas. "Owners of gas wells and gas producing properties," he urged, "should investigate very thoroughly the advance of science in converting methane (dry gas) into gasoline before selling their gas producing properties."

Natural gas has a surprising cash value and will become increasingly valuable in the immediate future, in Thompson's opinion. "In the perfecting of the process of converting methane directly into gasoline," he said, "of say 87-octane grade, natural gas immediately becomes worth at least 10 cents a thousand cubic feet at the well. It is possible that gas will be worth slightly more than 10 cents a thousand at the well when the experiments on the process of conversion of methane into gasoline is announced as an accomplished fact.

"It should be kept in mind that this process contemplates the extraction of all the liquid hydrocarbons first and then converting the methane (dry gas) directly into 87-octane gasoline.

"This discovery will greatly supplement our future gasoline supply and will make gas conservation vastly easier of enforcement.

"In the past there has been so little opportunity to sell natural gas that it has gone begging for a market.

"With the advent of this new process there should be no trouble whatever in convincing gas property owners to save every bit of their gas. They can take out the liquids like butane, propane, pentane, hexane, heptane, octane and others and still have the methane left to convert into 87-octane gasoline.

"We have in Texas today some 75 trillion cubic feet of gas in our known and discovered natural gas reserves. Using a rough rule of thumb of, say, 12,000 cubic feet of gas to one barrel of gasoline, you can see that the gasoline equivalent of our available natural gas is approximately as great as is our 12-billion-barrel reserve of crude oil in the known and discovered oil fields of Texas. When the true cash value of natural gas is generally known, self interest will make gas conservation enforcement easy."

IPAA Directors to Meet In New Orleans April 9-11

The mid-year meeting of the directors of IPAA will be held in New Orleans, April 9-11, 1945, and the annual membership meeting will be held October 15-17, 1945, site of the meeting to be determined later.

A series of district meetings in Texas and Louisiana have been concluded with independent oil men at each voting approval of the resolution adopted by the directors at their meeting in Dallas, October 9, denouncing the Anglo-American petroleum agreement.

To Study Oil-Gas Ratio

A. S. Ritchie, L. B. Stewart and Ray Smith, Kansas oil operators, have been named by the Kansas State Corporation Commission as a committee to study the ratio of oil and gas to be produced from the Zenith pool of Stafford County, Kansas.

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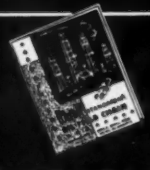

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UNION CHAINS

International Developments

Facts Revealed in Mexican Congress Oil Probe Are Variously Construed

Operation of Mexico's petroleum industry by the government company, Petroleos Mexicanos, has been officially upheld as successful in a Mexican congressional probe, but some unconvinced critics have asserted that facts revealed through the investigation actually have condemnatory implications.

Victor Alfonso Maldonado, president of the petroleum committee of the chamber of deputies, presented the findings of the investigation to the Mexican congress at Mexico City in the presence of a capacity crowd of hundreds of spectators, attracted by rumors that the committee's report would be devoted to an attack on the government oil monopoly.

Maldonado dismissed recent gasoline shortages as "a false alarm," and praised Pemex officials for the "success" of their management since the expropriation of American oil holdings in Mexico.

Nevertheless, the facts uncovered by the inquiry point to conclusions far different from those emphasized by the legislative spokesman. They showed that production has fallen off since the expropriation; employes' salaries have been tripled, which is regarded here as a sign of an alarming increase in bureaucracy within the organization; and while government income from the industry is said to have doubled, no mention was made of what percentage, if any, of the profits is being set aside to meet the country's petroleum debt.

Confining his report largely to a recapitulation of the latest statistics covering Mexican oil production, the congressman said:

"The [Mexican] oil industry has been a success both for Petroleos Mexicanos and the workers. The entire potential production is 120,500 barrels a day although only 101,000 barrels are being extracted in accordance with the national requirements.

"A total of 2,583,750 liters of gasoline is being produced daily; the consumption being 2,301,367 liters. Of the 1,032,876 liters of tractoline turned out daily, 836,000 are consumed. Production and use are balanced, and there should be no alarm in respect to a scarcity of these products.

"One of the obstacles confronting Petroleos Mexicanos is transport. There are nine pipe lines: Poza Rica-Azcapotzalco (with a daily capacity of 22,500 liters of gasoline), Poza Rica-Tuxpan, Poza Rica-Tampico, Alamo-Tampico, Tuxpan-Potrero, Ebano-Reventadero, Tonala-Minatitlan, Plan-Cuichipa, and Tonala-Nanchital. In Tampico, 90,000,000 liters of gasoline and 6,000,000 liters of tractoline cannot be moved because of the lack of facilities.

"Petroleos Mexicanos pays 95,657,290 pesos a year in taxes as compared with the 57,219,000 paid by American companies in 1936. Of the private enterprises' yearly output of 7,350,000 barrels, 4,400,000 barrels went abroad. Now Petroleos Mexicanos obtains 6,931,250 barrels annually, but they remain in the country.

"Salaries paid by the companies during 1937, one year before expropriation, came to 55,752,000 pesos whereas Petroleos Mexicanos pays 156,769,305 pesos a year."

The deputy concluded by observing that the local petroleum situation is a matter of patriotism. It should be criticized, he declared, only with exact figures and data and not with sensational accounts which play into the hands of private oil companies who, as he sees it, have not lost the hope of reviving a question that "for us has already been liquidated."

Four Areas Developed in England's New Oilfield

The new oilfield in southern England, location a military secret, had 242 producers by the end of September. The wells have been completed on pump, and average approximately 15 barrels each per day.

Four areas are under development in the field proper, totalling nearly 1½ square miles of proven acreage. Average depth of the wells is 3050 feet, all drilled with portable equipment. A deep test was coring at 7351 feet late in September.

Fire Extinguished

Caribbean Petroleum Company's La Paz 73 in Western Venezuela, which blew out several weeks ago and caught fire, was finally extinguished on October 15 by H. L. and O. L. Patton, fire fighters from Houston, who flew to Venezuela.

South American Production Is Fourth of U. S. Total

Petroleum production in South America during October is estimated at a daily average of 1,150,000 barrels, with good prospects of reaching 1,200,000 barrels before the end of the year. The current rate is approximately a fourth of the United States average, which was 4,740,000 barrels for the week ending October 21. Venezuelan output accounts for 78 percent of South America's total.

Production Resumed by Soviet in Galician Fields

Russia reports resumption of production in the Galician fields of Poland and the Ukraine. A number of wells was redrilled and on production by the middle of August and two refineries have been put back into operation.

Big-Inch Daily Rate to Be Maintained this Winter

Operations of the Big-Inch pipe line will be maintained throughout the winter at the 318,000-barrel daily rate of last month, it was disclosed by PAW in making public its schedule for November, December and January.

The schedules call for the delivery at Longview, Texas, of 126,500 barrels of East Texas oil daily, 68,000 barrels of oil from Southwest Texas, and 123,500 barrels from West Texas.

Contract Made to Extend New Mexico Pipe Line

Artesia Pipe Line Company, subsidiary of the New Mexico Asphalt and Refining Company, which operates a refinery at Artesia, New Mexico, has contracted for the extension of its Eddy County system from the Turkey Track area to the Loco Hills station of the Texas-New Mexico Pipe Line Company, involving 4 miles of 4-inch line.

The latter will deliver 2500 barrels of crude daily for two years from its Eddy County receipts to augment the crude demands of the Artesia plant.

Oklahoma Gas Properties Involved in Transaction

The Oklahoma Natural Gas Company, Tulsa, has contracted with Oklahoma Utilities Company to acquire Bristow and Mounds, Oklahoma, properties when the Securities Exchange Commission issues permission.

Involved in the deal are gas properties in Creek, Lincoln, Tulsa, Okfuskee and Okmulgee counties serving approximately 1800 customers. About 90 miles of transmission line of various sizes and between 70 and 75 miles of distributing lines make up the system. Gas production approximately balances the sales so there will be no additional drain on Oklahoma Natural Gas Company reserves.

Seven Loops on Carrier To Houston Authorized

The Texas-New Mexico Pipe Line Company has authorized the installation of 7 loops, aggregating 30 miles of 12-inch pipe, on its West Texas 12-inch carrier to Houston in order to attain more uniform balance of pressures. The loops will vary from 2 to 8.9 miles, and will be distributed between Crane and Katy stations. The year-round capacity of the line will be increased 5000 barrels to 65,000 barrels daily as result of the loops. The pipe is not due until early December.

Contract to Relay Section Of Missouri Line Awarded

Anderson Brothers Construction Company of Tulsa and Houston has been awarded a contract by Sinclair Prairie Oil Company to replace and relay approximately 18,000 feet of from 8 to 10-inch pipe line on the trunk system near LaPlata, Missouri.

Anderson has begun stringing approximately 20 miles of natural gas gathering lines ranging from 2 to 8-inch from the Buffalo gas pool to the Navarro Crossing oil pool in Houston County, Texas.

Crude Production and Refinery Runs Near Record Highs Provide Adequate Supplies

Desirable results in the adjustment of operations to prevailing and prospective requirements were reflected in statistics of the week ended October 28. Crude production and refinery runs were practically unchanged from the previous week, at levels not far under the highest on record; and refinery output of major products was sufficient to permit additions to stocks of gasoline and light fuel oils, although increased production of residual fuel oil did not prevent a moderate withdrawal of that product from storage.

U. S. crude production of 4,740,000 barrels a day in the week of October 28 was a nominal decrease of 4000 barrels from the week before but was only 22,000 barrels under the record high of late September and 358,000 daily or 8.2 percent above production in the corresponding week last year. Crude runs to stills averaged 4,658,000 barrels daily, also down 4000 from the previous week, although only 17,000 a day under the all-time peak of the final week of September, and 474,000 daily or 11.3 percent above runs in the comparable week last year. Crude oil stocks (refinable) totaled 221,711,000 barrels on October 21, having declined 1,163,000 barrels from October 14, and the new figure was only about a million barrels above the 23-year low reached in early September this year. The present inventory of crude is about 14,000,000 barrels or 6 percent less than that held a year ago.

Production of gasoline, including natural blended at refineries, averaged 2,017,000 barrels daily in the week of October 28, down 63,000 from the week before but 195,000 a day or 10.7 percent higher than in the like week a year ago. Stocks of finished and unfinished gasoline accumulated at the rate of 27,000 barrels daily, having risen during the week from 78,866,000 to 79,058,000 barrels. The latter amount was approximately 10,000,000 barrels or 14.4 percent more than the 69,092,000 barrels held on October 30 last year.

Gas oil and distillate fuel oil production of 682,000 barrels daily was 39,000 less than the week before but 7000 a day more than in the corresponding week last year. Stocks continued to increase in spite of the cutback of production, having risen at the rate of 72,000 barrels daily to a total of 48,863,000 barrels on October 28. That amount was about 4 million barrels or 9 percent more than the 44,713,000 barrels reported as of October 30 a year ago.

Residual fuel oil production of 1,284,000 barrels daily was 14,000 a day more than the week before and 143,000 a day or 12.5 percent more than output in the like week last year. Stocks of residual fuel were drawn upon, however, by 40,000 barrels daily and declined to 64,224,000 barrels. That amount was slightly more than the 63,765,000 barrels on hand October 30 last year.

☆

HUGH STURM, 77, of Ardmore, Oklahoma, died October 28. With his brothers, J. W. and W. P. Sturm, he drilled one of the first wells in Corsicana, Texas, in 1895. For years he was active in development in the southern Oklahoma district.

Daily Average Demand for Crude Put at 4,760,000

Daily average demand for domestic crude this month was placed by the Bureau of Mines last week at 4,760,000 barrels. PAW certifications for the month call for production of 4,720,500 barrels of crude daily.

Demand for domestic crude for this year will run about 4,645,000 barrels daily, an increase of 13 percent over 1943, it was estimated by the bureau. Demand for the first quarter was 4,478,000 barrels daily and for the second quarter, 4,623,000 barrels. Third quarter demand is estimated at 4,720,000 barrels, and fourth quarter at 4,760,000 barrels.

On the basis of data so far available, demand for motor fuel for the third quarter was estimated at 197,000,000 barrels, an increase of 15 percent over last year but approximately 2 percent less than was forecast.

Trends of Operations and Changes in Stocks

Figures on crude stocks are from Bureau of Mines weekly reports; all others from American Petroleum Institute weekly reports, which are estimates on Bureau of Mines basis.

(All figures in thousands of barrels—add 000)

HIGHS AND LOWS OF RECENT YEARS

ITEM	Crude Oil Prod.		Runs to Stills		Crude Stocks		Gasoline Stocks		Gasoil and Distillate Stocks		Residual Fuel Oil Stocks	
	Barrels Daily	Week Ended	Barrels Daily	Week Ended	Barrels	Week Ended	Barrels	Week Ended	Barrels	Week Ended	Barrels	Week Ended
Highs:												
1941	4,337	11-22	4,120	10-18	266,187	3-29	99,727	3-29	[1]54,983	11-15	102,448	1- 4
1942	4,337	2- 7	3,961	1- 3	263,208	3-28	[1]109,281	3-14	47,861	11-14	95,857	1- 3
1943	4,436	11-13	4,331	12- 4	245,752	5-29	94,159	3-20	47,187	11-27	72,881	1- 2
1944	[1]4,762	9-30	[1]4,775	9-30	240,992	1- 1	89,162	4- 1	48,863	10-28	64,644	10- 7
Lows:												
1939	[3]1,601	8-26	3,125	2-18	[2]229,127	10-12	71,152	10- 7	20,722	4-15	105,397	4- 8
1941	3,364	1-11	3,490	1-18	240,399	11-15	79,923	10- 4	28,382	4-12	90,914	7-12
1942	3,297	7- 4	3,393	5-23	231,896	12-12	75,934	12- 5	29,240	4-25	72,962	12-26
1943	3,821	1- 9	3,579	3-13	232,191	1- 9	68,182	10-16	30,732	4- 3	57,596	12-25
1944	4,357	1- 1	4,228	2-12	[4]220,623	9- 9	76,302	1- 1	30,232	4-29	49,737	3-18

TRENDS OF 1943 AND 1944

Trends in Week Ended:	Crude Oil			Gasoline		Gasoil and Distillate		Residual Fuel	
	Production Daily	Runs to Stills Daily	Stocks Week End	Production Weekly	Stocks Week End	Production Weekly	Stocks Week End	Production Weekly	Stocks Week End
1943:									
January 2	3,871	3,734	233,938	10,957	82,420	4,285	42,913	7,683	72,881
January 30	3,826	3,698	233,863	10,339	88,830	3,888	37,057	7,452	70,763
February 27	3,873	3,709	235,217	10,566	93,157	4,230	32,939	7,839	70,140
March 27	3,896	3,742	239,126	10,231	94,079	3,541	30,980	8,018	67,938
April 24	3,913	3,737	242,035	10,583	91,001	3,954	31,142	8,168	67,455
May 29	3,970	3,679	245,752	10,656	83,937	3,798	32,274	7,672	67,582
June 26	3,955	4,015	242,657	11,092	79,589	3,876	34,044	8,126	67,960
July 31	4,133	3,788	238,420	11,127	74,977	3,765	36,363	8,478	66,877
August 28	4,196	4,227	236,170	12,420	72,525	4,351	37,928	8,732	67,250
September 25	3,344	4,156	233,013	12,206	70,024	4,608	40,328	8,560	66,659
October 30	4,383	4,176	247,219	12,813	69,297	4,642	44,591	7,968	63,833
November 27	4,414	4,261	239,761	12,638	69,980	4,379	46,187	8,633	62,143
December 25	4,363	4,185	241,310	12,597	74,024	4,457	43,791	8,689	57,596
1944:									
January 1	4,357	4,453	240,992	13,192	76,302	4,575	42,310	9,141	57,330
January 29	4,409	4,359	240,251	13,427	81,085	4,054	37,266	8,889	52,857
February 26	4,423	4,377	237,137	13,183	85,248	4,558	33,766	8,952	51,387
March 25	4,385	4,443	236,285	13,362	87,287	4,979	31,319	9,013	51,660
April 1	4,383	4,435	234,667	13,824	89,162	4,450	30,530	8,367	51,326
April 29	4,431	4,300	235,342	13,126	88,462	4,284	30,236	8,398	49,985
May 27	4,514	4,532	234,423	13,502	86,468	4,702	32,035	8,568	49,812
July 1	4,587	4,638	228,860	14,052	83,559	4,496	35,360	8,872	52,235
July 29	4,608	4,627	225,112	14,115	82,665	4,833	38,135	8,900	56,280
August 26	4,667	4,698	222,931	14,112	80,740	4,566	41,453	8,680	59,839
September 30	[1]4,762	[1]4,775	222,393	14,494	78,028	4,622	45,329	9,292	64,226
October 7	4,691	4,506	222,500	14,252	78,554	4,706	46,078	8,676	64,644
October 14	4,726	4,589	222,874	14,442	78,506	5,398	47,335	8,827	64,365
October 21	4,744	4,662	221,711	14,559	78,866	5,030	48,360	8,889	63,944
October 28, 1944	4,740	4,658	.....	14,117	79,058	4,772	48,863	8,985	64,224
October 30, 1943	4,382	4,184	[5]235,998	12,756	69,092	4,726	44,713	7,987	63,765
Change:									
In week	—4	—4	—1,163	—442	+192	—258	+503	+96	—280
In year	+358	+474	—14,287	+1,361	+9,966	+46	+4,150	+998	+459
In year	+8.2%	+11.3%	—6.1%	+10.7%	+14.4%	+1.0%	+9.3%	+12.5%	+0.7%

[1] All time peak. [2] Lowest between January, 1922 and July 1, 1944. [3] Lowest since October, 1922, due to shutdown of six Mid-Continent states. [4] Lowest since December, 1921. [5] Stocks, October 23, 1943.

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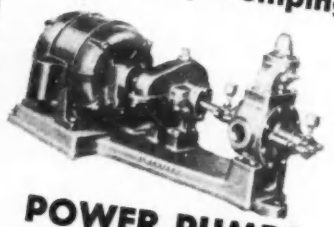

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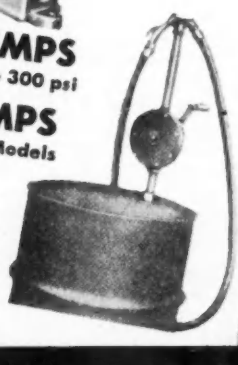

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U. S. Field Operations

California

Shell Opens New Producing Area in Los Angeles Basin

Shell Oil Company, Inc., has apparently opened a new producing area 2 miles north of the Val Valle field in the Los Angeles Basin. Their Claiborne 88-4, SE SE 4-4-17, is swabbing clean oil from 3910-4015 feet.

Kern County: Reserve Oil and Gas Company 33-7, 33-11-19, is swabbing and flowing by heads to sump frothy oil, mud and emulsion. Oil tests 19-gravity. Depth is 2765 feet, plugged to 2720 feet, with 145 feet of 5-inch liner landed at 2720 feet, including 100 mesh perforations from 2720-2655 feet. Two and one-half-inch tubing, including 193 feet of 2-inch on the bottom, is hung at 2700 feet.

Richfield Oil Corporation's Tejon B 55-35, 34-11-19, is preparing to make a formation test of oil sand logged at 2648-2695 feet. Top of Main oil sand was placed at 2648 feet. On a test at 2568-2627 feet, open 43 minutes, it flowed at a daily rate of 1,000,000 cubic feet of gas. Recovery was 100 feet of gas-cut mud.

Bender Drilling Company's Vedder 41-I, new discovery in 14-28-28, was completed on the pump for an estimated 200 barrels of 13-gravity oil per day. It sanded up October 28 and is now cleaning out. Production is coming from the Vedder sand, topped at 2634 feet.

Los Angeles County: Ohio Oil Company is preparing to spud Legrand, wildcat test in SE SE 30-1-9, San Jose Hills area.

Shell Oil Company, Inc.'s Bryant 2-1 is drilling at 5971 feet in shale. Only a few minor oil showings were logged in the Selover zone. Bryant 6 is coring at 8209 feet. Several formation test attempts have been packer failures.

Oklahoma

Chimney Hill Production Expected in West Edmond

Mid-Continent Petroleum Corporation's Mullins 2, NE NW SW 29-10n-3w, West Moore pool, Cleveland County, which tested dry in the Wilcox, recovered 30 barrels of distillate and 3,500,000 feet of gas after reacidizing in the dolomite at 8628-64 feet, while Stanolind Oil & Gas Company appeared about to open production in the Chimney Hill section of the Hunton lime, West Edmond pool. Mid-Continent apparently has drilled another defining well in West Moore as Turk 1, C NE 29-10n-3w, was shut down for orders at 8981 feet after penetrating a dry Wilcox sand and checking some 31 feet lower with the discovery well to the southwest.

West Edmond: With production established in the Bois D'Arc or upper Hunton, Stanolind's Pauly 1, C NW NW 27-14n-4w, Oklahoma County, is being closely watched after drill stem tests in the Chimney Hill or basal Hunton from 6698-6724 feet recovered an estimated 140 barrels of oil daily. On another test the well showed 450 feet of 42-gravity oil and 810 feet of oil-cut mud, and afterward swabbed 22 barrels natural in 9 hours. Three miles west of production, Fox & Fox's Simpson 1, C SE SW 9-14n-5w, Canadian County, was preparing to test the Hunton, topped at 7500 feet. The well is at total depth of 7665 feet with no information on Hunton shows. A well would expand the pool for a width of 6½ miles. Other wildcats in the general area include Amerada Petroleum Corporation et al's Lawson 1, NE SE NW 18-11n-5w, drilling below 5215 feet, top of Tonkawa 4957 feet; Sohio Oil Company et al's Robson 1, C NE NE 12-13n-5w, top of Mississippi lime 7010 feet, drilling below 7200 feet; Stanolind et al's Drake 2, C SE NE 13-14n-5w, fishing at 4961 feet. All are in Canadian County.

Cities Service Oil Company's Gaffney 1, SE SE 29-15n-4w, gasser in the Bartlesville, was shut down on squeeze job after gas broke out around casing and showed up in a nearby creek. Completed for 10,800,000 feet of gas it was opened to relieve pressure and flowed 75 barrels of 63-gravity distillate through tubing in the first 12 hours, and 349 barrels and 8,800,000 feet of gas in the next 20 hours with no water showing.

Noble County: Mid-Co Oil Corporation and Mid-Continent staked an important wildcat on a 1700-acre block for a Wilcox test on a pronounced shot high on a trend from the Tonkawa pool to the Billings pool. Work order was issued for Robertson 1, NW SE 30-24n-1w.

McClain County: The Carter Oil Company's Johnson 1, C SW SE 30-8n-2w, Noble area pool opener, was flowing 322 barrels of fluid a day and cutting between 2 and 3 percent water through perforations at 8190-8200 feet in the Wilcox. Carter's Lamar Ranch 1, C NE SW 28-8n-3w, topped Caney Shale at 9655 feet and was drilling in Woodford below 9918 feet; McBride 1, C SE NW 9-17n-3w, was drilling below 4530 feet. These are deep tests in the Anadarko Basin on the west flank of the Granite Ridge.

Logan County: Continental Oil Company is determining what made an abandoned well kick off to open a possible new producing horizon in the Guthrie pool. The Suits 1, SE SE NW 7-17n-1w, exhausted in the Bartlesville and Wilcox zones, ripped pipe at 2615 feet and encountered 2,000,000 feet of gas. Ripped again at 2502 feet the gas cleaned out the hole and was estimated at 40,000,000 feet with some salt water after which the well was killed with mud pending fur-

Wells Completed in United States in Week Ended November 4, 1944

Data preliminary and subject to revision. Revised and more complete data on all completions shown in monthly summary of drilling, published in second issue of each month. More detailed data on wildcats published in third issue of each month.

State or District	FIELD COMPLETIONS: New Wells *Oil	Gas	†Input	Dry	Total	Old Wells Deepened	WILDCAT COMPLETIONS *Oil	Gas	Dry	Total	ALL COMPLETIONS: This Week	Last Week	Cumulative: This Year	Last Year
Alabama									2	2	2	1	34	2
Arizona													6	5
Arkansas	1				1				2	2	3	4	196	221
California‡	68	1			69				6	6	75		1,753	1,218
Colorado									1	1	1	1	26	23
Florida													3	5
Georgia												1	7	3
Illinois	16			11	27	2			6	6	35	53	1,663	1,536
Indiana	1			5	6				1	1	7	8	287	233
Iowa													2	3
Kansas	12			1	13	1	1		10	11	25	21	1,449	1,467
Kentucky	1			2	3				2	2	5	16	653	350
Louisiana	7	6		3	16						16	11	646	550
North Louisiana	2	5		1	8						8	4	228	256
South Louisiana	5	1		2	8						8	7	418	294
Michigan	4	1		4	9				5	5	14	23	585	505
Mississippi	3				3				3	3	6	9	170	83
Missouri	1				1						1		37	23
Montana	7			1	8				3	3	10	7	292	184
Nebraska												1	11	37
New Mexico	8	1		5	14						14	12	352	230
New York	15		10		25						25	25	1,061	1,058
Ohio	1	3	1		5						5	10	745	687
Oklahoma	22	1	1		24		4	1	4	9	33	25	1,565	1,224
Pennsylvania	27	6	15	3	51						51	49	2,471	2,150
Tennessee													9	6
Texas	64	6		9	79	3	4	2	25	31	113	144	5,162	3,585
E.Tex.Bor. Co.'s		2			2			1		1	3	1	31	17
E Texas Field													3	5
Rest of E. Texas	2				2				6	6	8	5	245	203
North Texas	3			3	6	1	1		7	8	15	31	1,181	892
W. Central Tex.	1				1	1			2	2	4	12	345	325
West Texas	30				30	1	1		4	5	36	35	1,365	793
Tex. Panhandle	10	2			12						12	10	221	167
G. Coast, Upper	4	2		4	10				2	2	12	13	504	274
G. Coast, Lower	13			1	14		1	1	2	4	18	18	797	539
Southwest Texas	1			1	2		1		2	3	5	14	381	316
S. Central Tex.												4	89	54
Utah													1	
West Virginia		15		3	18						18	14	799	582
Wyoming	4				4		1			1	4	6	148	105
Total U. S.	262	40	27	47	376	6	10	3	70	83	463	440	20,133	16,075

* Includes distillate wells. † Includes salt water disposal wells. ‡ California data shown here for week ended Nov. 4, include 38 oil wells and 1 gas well completed in week ended Oct. 28, but delayed for these records.

ther information and an attempt to save the well.

Garvin County: After acidizing the Burns sand in the Pennsylvanian, Ohio Oil Company's Ramsey 1, NE SE 13-3n-1e, on the west side of the East Pauls Valley pool, was increased from a 25 to a 100-barrel pumper. Total depth is 3250 feet with pipe perforated at 2960-88 feet.

Stephens County: The Texas Company's Bateman 1, SW NW NE 21-2n-8w, total depth 6540 feet, was shot with 300 quarts at 6163-89 feet and flowed 71 barrels of oil in 24 hours through 1-inch tubing choke. This Marlow area wildcat was fishing for lost swab. Carter et al's Frensley 1, NEc 12-1n-6w, in the Cruce gas area, was drilling below 3820 feet in the Springer shale where a core at 3807-17 showed an 80-degree dip in the formation.

Missouri

In Jackson County, Rafner Elevator Works abandoned Fee 1, NEc 4-59n-33w, after recovering salt water in the Burgess sand from 815 to 820 feet, total depth. In the Boot Heel district of Stoddard County, M. H. Marr et al's Barnett 1, C SW SW 3-25n-11e, was drilling below 500 feet.

Nebraska

L. M. Bates staked Fritz 1, SE SE SE 34-3s-15e, wildcat 1½ miles north of Verdon, Richardson County. Associated with Bates are John Peters and E. S. Towle of Falls City. The test is said to be supported by Cities Service Oil Company. Bates and associates have a block of 2500 acres.

Southern Oklahoma Area Sees Extensive Activities

As the result of extensive geophysical and geological work followed by recent discoveries, the southern Oklahoma area north of the Arbuckle and Wichita Mountains is commanding considerable attention among operators, lease and royalty brokers. This area includes the oil pools of Healdton, Hewitt, Graham-Fox, Sholem-Alechem, Walters, Tatums-Tussy, Robberson and others.

Large lease and royalty buying campaigns have developed and 120 wells are drilling in the general area of which 30 are wildcats. Sub-leasing of deep rights in shallow pools was given significance by the recent find of deep Hunton lime pay in the Graham pool of Carter County. Another recent outstanding discovery is the Lone Grove pool also in Carter County where The Texas Company has developed good production from a number of shallow Pennsylvanian sands.

A summary of drilling wells by counties follows: Carter, 22; Love, 12; Marshall, 12; Bryan, 11; Atoka, 4; Stephens, 59; Jefferson, 2; Comanche, 12; Cotton, 2; Tillman, 5; Kiowa, 5; and Jackson, 1.

☆

FRED A. HENNINGER has been named manager of the service department of Anchor Petroleum Company, Tulsa, Oklahoma, producers and marketers of butane-propane.

WILLIAM O. TAYLOR has resigned as tax attorney for Superior Oil Company, and will be associated with the law firm of Butler and Binion, Houston. He did tax work for Humble Oil & Refining Company before his connection with Superior.

Kansas

Two Tests Open New Pools; Wildcat Activity Gains

Two tests definitely opened new pools and 3 others had the earmarks as Kansas operators ground away with 96 wildcats scattered throughout the state as compared with 70 at this time last year. Twenty-one routine wells were completed for total new production of 7660 barrels a day and 16 tests were dry.

Pratt County: The Texas Company's Smith 1, C SE SE 6-26s-13w, ½ mile west of the Frisbie pool, was waiting for tanks after completing for a pumper on swab testing 94 barrels of oil daily. Total depth is 4049 feet with pipe perforated in the Kansas City lime at 3920-36 feet.

McPherson County: Williams & Morine's Henne 1, SWc 4-17s-1w, is a pool opener 1½ miles north of the Henne pool. Topping Mississippi lime, the producing zone, at 2618 feet, 5-inch was set at 2620 feet and the well drilled to 2645 feet, total depth. After being cleaned it filled with 1200 feet of oil and swabbed 5 barrels of oil in 30 minutes. Operators were installing pumping unit.

Russell County: A mile north of the Forest Hill pool, Harry Gore's Brack 1, SW SW NE 17-15s-12w, was testing the Arbuckle topped at 3300 feet with oil string set at 3302 feet and hole drilled to 3306 feet. After cleaning the hole filled with 2000 feet of oil and pumping unit was being installed.

Barton County: J. T. Phoenix et al were testing a good oil show in Birzer 1, NE SW 21-19s-11w, in Lansing lime topped at 3021 feet. The possible pool opener is 1½ miles north of the Ellenwood North pool. Five-inch casing was set at 3139 feet and the well drilled to 3168 feet, where it swabbed considerable oil after acidizing with 500 gallons. Interesting county wildcats include Bridgeport Oil Company's Leibl 1, NE NE NW 16-18s-11w, drilling below 1415 feet; Vickers Petroleum Company's Bertz 1, SE NE NW 32-17s-11w, drilling below 2162 feet; Black-Marshall's Thompson 1, NW NW NW 6-17s-12w, drilling at 1500 feet.

Brooks County: W. L. Hartman set oil string to test saturated Arbuckle in Peterson 1, NE NE SW 22-8s-19w, topped at 3388 feet; Globe Oil Company et al's Federal Farm Bureau 1, NW NW NE 20-9s-19w, cored two feet of saturated Lansing lime topped at 3307 feet and continued drilling below 3340 feet.

New Mexico

State's Deepest Producer Flows from Ordovician

Humble Oil & Refining Company's Leonard-Federal 1, Southeastern Lea County wildcat, gave New Mexico its first Ordovician production in flowing 25 barrels of oil hourly with gas volume rated above 1,000,000 feet daily on preliminary test through ¾-inch tubing choke. Production is from perforations at 11,890-11,928 feet in Ellenburger, topped at 11,918 feet, becoming the record depth producer for the state and the Permian Basin. The well did not flow until treated with 1000 gallons of mud acid. Development of the area will be on a cautious basis due to the sharpness of the Ordovician structure and expensive drilling.

Continental Oil Company et al's Skaggs 2-B-23, projected Ellenburger test between the Monument and Skaggs fields, was drilling lime and shale at 10,460 feet in Simpson. An intrusive sill of granite was encountered at 10,430-10,456 feet.

Tonto Pool: Dalport Oil Corporation's Cole 1, southeast offset to the discovery, rated at 3 to 4 barrels oil daily from thin sand at 3583 feet, and was drilling at 3617 feet with more pay due near 3630-foot level. It is low structurally. The Texas Company's Baskin 2, north offset to its flowing discovery, cemented 5½-inch casing at 3490 feet, and was drilling in lime at 3535 feet, with a show of gas at 3521-25 feet. Bobb 1, 2 miles northwest, temporarily set 7-inch casing at 3933 feet to deepen to the red sand pay that is productive in Eddy County.

Deep Test: In the Maljamar area, Barney Cockburn et al's Wyatt 1 was drilling unidentified lime at 6970 feet, carrying 6000 feet of oil and water, while Phillips Petroleum Company's Lea-Mex 4 was drilling lime at 6210 feet. Humble Oil & Refining Company's Keinath-Federal 1, near the east border of Lea County, missed the Clear Fork pay and was drilling limey-chert at 8930 feet on Ellenburger contract. Sanders Brothers' Hultman 1, wildcat and deepest test given Eddy County, was due to deepen from 6761 feet in the Pennsylvanian.

Revision of Allocation In Hawkins Is Denied

The Texas Railroad Commission has denied application of Humble Oil & Refining Company to revise the method of allocation in the Hawkins Field, Wood County. The proration plan was changed earlier this year to conform to some extent to Humble's request. However, the company contended that it did not gain sufficiently by the revision.

At a recent hearing, Humble sought a further increase in its share of the allowable and it was this application the commission denied. The order was of unusual length and carried a complete history of the case, together with the commission's reasons for the denial. Humble has sought to have the method of allocation fixed on a basis that would enable it to produce daily an allowable in proportion to its ownership of reserves in place.

Boston Mountain Study

Interpretation of exploratory wells drilled for oil or gas in the Boston Mountains region in northwestern Arkansas will be aided by a stratigraphic study of the rocks of the Batesville district, Independence County, Arkansas, publication of which was announced by William E. Wrather, director of the Geological Survey, Department of the Interior, Washington, D. C., at 40 cents each.

Recycling Plant

The Duval Gasoline Company has been granted a Texas Railroad Commission permit to operate a recycling plant in the Southland Field, Duval County.

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West Texas

Winkler County Test Lists Devonian as Producing Zone

Sun Oil Company's Wheeler 1, southwest edge of the Wheeler-Ellenburger field, Winkler County, listed the Devonian as a new producing zone for the area when tester was used at 8527 feet with top of Devonian called at 8348 feet. The well was drilling at 8540 feet to explore the Ellenburger.

Wildcats: Sinclair Prairie Oil Company's McKnight 1, northwest Crane County, entered dry Devonian at 7925 feet, and was drilling chert at 7990 feet. Gulf Oil Corporation's McKnight 6-E 4¾ miles to the southwest and on a higher structure, was drilling basal Simpson at 7260 feet, having passed up favorable showings in the McKee and Waddell sands. In Andrews County, Stanolind Oil & Gas Company's University 1-D, with flowing production assured from upper zones, was drilling at 8940 feet, with top of Silurian tentatively called at 8820 feet. Shell Oil Company and Cities Service Oil Company's T. P. Land Trust 1, which has indicated production from 3 or more deep zones, was drilling shale at 9690 feet.

Winkler County: Texas Company's Hogg 1, 1¼ miles northwest of the North Monahans 3-well pool, was preparing to perforate with 7-inch casing on bottom at 6250 feet after indicating production in drilling through the Clear Fork zone. A drill stem test at 6088-6250 feet yielded 720 feet of oil and gas cut mud and 270 feet of rotary fluid.

The fourth productive oil zone for the Keystone structure was further confirmed when Gulf Oil Corporation's Keystone 50-E, ⅝-mile southeast of Ellenburger production, flowed at a rate of 30 barrels of 38.4-gravity oil hourly against 1500 pounds working pressure when tester was used in the Silurian at 7832-82 feet. Previous tests and a later test at 7871-7968 feet, which returned 360 feet of oil and gas cut mud, reveal more than 200 feet of probable Silurian pay. Sun Oil Company's Keystone 2, 2 miles north by west of deep production, was drilling limey-shale at 9965 feet. Richardson & Bass, Inc.'s Kansas City 1, 2¾ miles southeast of deep production, failed to make a producer in the Holt and was drilling in lime at 5330 feet. Development of the Holt and Ellenburger pays is being expanded as rigs become available.

Gaines County: Shell Oil Company's Sparks 1, 12 miles southwest of the Seminole field, recovered 140 feet of rotary fluid with a nominal show of oil and gas when tester was used at 9946-10,045 feet. This wildcat was drilling unidentified dolomite at 10,155 feet.

Lamb County: Humble Oil & Refining Company's Jackson 1, 3 miles northeast of Anton and the first prospective producer on top of the deep-seated granite ridge that extends east-west cross the basin, was awaiting a nitro shot in broken oil saturation at 5352-5921 feet. This wildcat bailed ½ barrel of fluid hourly, averaging 50 percent oil and the remainder water after plugging back from granite at 7191 feet to 6050 feet in the Clear Fork. The company will next drill Bagwell 1, SWc Labor 25, League 673, State Capitol Lands, 13¾ miles west by north, and will try for Ellenburger production. Woodley Petroleum Company's Bird 1, 7½ miles northwest of Jackson 1, proved dry in the Clear Fork, topped at 5170 feet and the Tubbs zone at 5761 feet, but was drilling lime at 6250 feet.

Crane County: The Texas Company's Hobbs 3-B, 1⅜ miles north by west of Devonian production in the Crossett area, entered dry Devonian at 5110 feet, 243 feet high, and had reached water in drilling Simpson sandy-lime at 5675 feet. This outpost has uncovered an unusual structural condition, having entered the Silurian at 5165 feet, being 523 feet high to the discovery, and topped the Montoya at 5270 feet, thereby gaining additional structural relief. Gulf Oil Corporation's Waddell et al 65-K-T, near McKnight production in the Sand Hills area, flowed at a rate of 60 barrels oil hourly when tester was used at 3245-3320 feet in McKnight.

Failures: Ray A. Albaugh et al's Albaugh 1, Howard County prospect, was listed for plugging without shows at 5010 feet. In Midland County, Richfield Oil Corporation's Boone 1 quit in dry lime at 4508 feet. Champlin Refining Company's University 1-B, Andrews County, failed in a series of plug back tests from 8536 feet, although a producer was anticipated from the Clear Fork.

West Central Texas

Production Tests Under Way On Two Flippen Discoveries

The Texas Company's Sales 1-C, Labor 9, League 122, W. R. Willis Survey, Taylor County, pumped 29 barrels of oil in 12 hours after using 2000 gallons of acid in Flippen at 2268-84 feet with the hole bottomed in shale at 2285 feet. This strike is a west offset to a 3206-foot failure that fell short of making a commercial pumper from the same zone. Great Lakes Carbon Corporation's Jones 1, Wm. Bishop Survey, 7½ miles east of the Dunigan area, was rated as a 50-barrel pumper after using 4000 gallons of acid in Flippen at 2009-34 feet, having plugged back from 2508 feet.

Coleman County: Harvey and Henderson's McCord 1, J. W. Meeks Survey and within a cluster of failures that showed free oil, swabbed 15 barrels of oil on a 12-hour test after using 1000 gallons of acid at 2670-98 feet, having plugged back from 3844 feet.

North Texas

Good Structural Position Of Clay Outpost Confirmed

Favorable structural position of D. D. Feldman et al's Stine 2, southeast outpost for the spring sector, Ringgold area, Clay County, was confirmed when drill stem test of saturated Bend at 5888-5606 feet yielded gas in 4 minutes and a steady flow of oil in 8 minutes. Pipe will be landed on top of Bend at 5561 feet.

Montague County: Stanolind Oil & Gas Company's Gossetti, 2 miles west by south of the Anes 1—well pool, logged oil saturation in Bend conglomerate at 5758-60 feet and 5862-65 feet, but failed to produce on drill stem test, and was drilling shale at 5960 feet. J. A. Chapman et al's Daube 1, 1¾ miles southeast of the Chapman-McFarlin pool, was awaiting orders at 6710 feet, having logged nominal oil shows in several zones below 5500 feet.

Cooke County: The Texas Company's Rasure 1, Sivels Bend prospect, was installing pump after swabbing 6 barrels of pipe line oil hourly from Strawn perforations. This wildcat was drilled to 7518 feet without reaching the base of the Strawn, and completion has been delayed by casing leaks. The company has skidded rig for an offset.

Clay County: Bridwell Oil Company's Ewers 1, Sec. 14, Block 1, Clark-Plumb Survey, and 2½ miles east by north of a Strawn pumper, nearest production, will attempt to complete in saturation at 5366-88 feet in Bend, topped at 5352 feet, although drill stem test yielded only 45 feet of oil cut mud. Fain & McGaha's Ross 1, ¾-mile southwest of the Ross 3-pay area, was testing after using 3000 gallons of acid in Basal Bend at 5642-64 feet.

Throckmorton County: Panhandle Refining Company and Anderson-Prichard Oil Corporation's Ewalt 2, ½-mile west of their Ewalt 4100-foot Bend discovery, recovered 1600 feet of oil and 700 feet of water when tested was used in the Mississippi at 4780-4810 feet, and was drilling at 4960 feet to explore the Ellenburger before running pipe. Ewalt 2 entered the Bend at 4180 feet, 7 feet low, but drill stem test indicated possible well.

Collin County: Pure Oil Company's Light 1, second slim-hole test for its 58,000-acre block in the Celina area, was credited with having reached dry Ellenburger in drilling at 5410 feet.

☆

S. W. OSBORNE, formerly of Ponca City, Oklahoma, has been transferred to Oklahoma City as district manager for Oil Well Supply Company, succeeding Don Collins, who has been sent to Dallas as midwest manager of machinery sales.

East Texas

Completions Reported by Two Carthage Area Wells

Humble Oil & Refining Company's Pickering Lumber Company 1, S. Francis Survey, Shelby County, is coring below 3235 feet in shale and lime after making a drill stem test at 3200-15 feet following recovery of limestone and shale with a good odor at that point. Recovery on the test was not reported. Top of Fredricksburg lime was picked up at 3196-3200 feet.

Panola County: Skelly Oil Company's Blankenship 1, 5 miles west of Carthage in the Carthage field is coring below 6075 feet.

Southern Production Company's A. C. Soape 1, 4 miles southwest of Carthage in the Carthage field, has been completed, making 75,000,000 cubic feet of gas daily from 159 perforations at 5905-30 feet in the upper Pettit and 56,000,000 cubic feet of gas daily from perforations at 6056-6116 feet, and 6140-60 feet in the Lower Pettit. Lower perforations were treated with 2000 gallons of acid.

Final completion on Skelly Oil Company's Houston Wills 1, 10 miles west of Carthage has been reported, the well making 21,000,000 cubic feet of gas

daily on open flow from the upper Pettit perforated from 6165-85 feet. Distillate was estimated at 22 barrels per million cubic feet of gas. The lower Pettit showed salt water.

Harrison County: Gregg-Tex Gasoline Company et al have made location for T B. Page 1, wildcat in the H. R. White Survey, and are awaiting a rig.

Angelina County: Humble Oil & Refining Company's Angelina Lumber Company 1, proposed 10,000-foot wildcat in the area 10 miles northwest of Lufkin, is reaming the hole after drilling to 4447 feet.

Rusk County: H. C. Owens et al's Rousseau 1, Robert Gilkerson survey, midway between Minden and Pine Hill, tested a small volume of gas and flow of salt water from Pettit perforations at 7110-23 feet. This was rated as the most likely production of two zones, and the wildcat will be completed in the Travis Peak gas-distillate sand, which previously yielded in excess of 3,000,000 feet of gas daily from perforations at 7382-89 feet.

Smackover Tests: Humble Oil & Refining Company's Searcy 1, Mount Pleasant prospect, Titus County, was drilling sandy shale at 9490 feet in Cotton Valley, topped at 9135 feet. H. C. Cockburn et al's Cockburn-Gilliam 1, Falls County, landed surface pipe. In the Eylau pool, Bowie County, Barnsdall Oil Company and Sohio Petroleum Company's Gifford-Hill 1, 1000 feet west of their 7700-foot discovery, entered the Buckner at 7450 feet, or 15 feet high, and was drilling at 7680 feet.

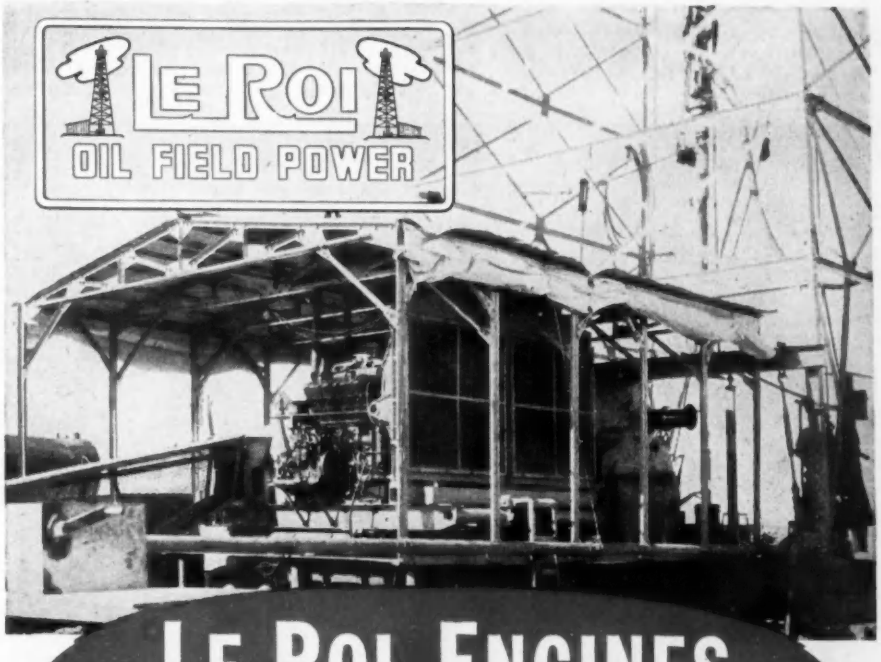
Robertson County: Hamman Oil and Refining Company's Gibson 2, 900 feet northeast of its 2100-foot Basal Navarro pumping discovery, missed the Navarro sand in drilling to 2242 feet, and will be abandoned. A third test for the 1825-acre lease will follow. The discovery, first commercial well for the county, was pumping 4 barrels of 35-gravity oil hourly from Basal Navarro at 2181-94 feet.

Southwest Texas

Karnes Wildcat Completed As Gas-Condensate Well

Smith & McBride, Inc.'s W. C. McCaskill 1, wildcat south of Runge and south of Pettus production in the Porter area, Karnes County, has been completed as a gas-condensate well after reperforating casing at 7404-09 feet, flowing through a ⅛-inch choke under equalized tubing and casing pressures of 2000 pounds with no estimate on the total open-flow potential of gas, but with condensate content of the gas estimated to be 25 barrels per million feet of gas. It is shut in preparing for potential test. Total depth was 8650 feet with the 5½-inch casing cemented to 7500 feet. Previous tests with casing perforated at 7421-22 feet showed salt water only.

Brooks County: Standard Oil Company of Texas is preparing to complete its Braulia de Garcia 4 to open a new area in a new sand 1½ miles southeast of the Alta Mesa field, southwestern Brooks County. This well, testing for several weeks in various sands, will perforate at 7420-74 feet and complete as a gas-condensate well, having recovered gas and condensate on several tests at



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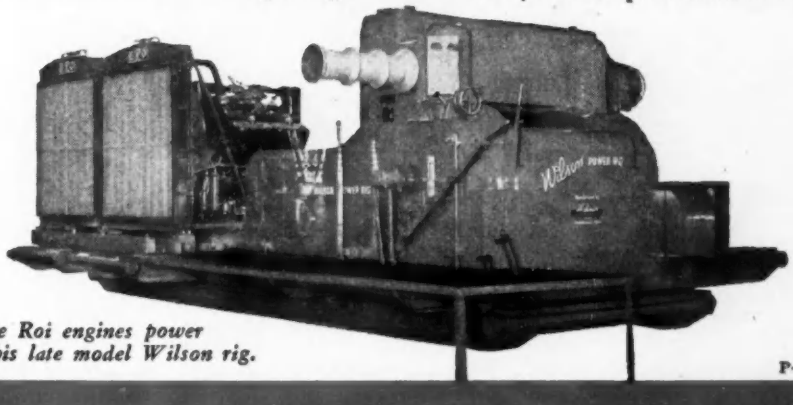

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various points within this sand section. Location has been made for Braulia de Garcia 5, 4513 feet northeast of the No. 4 well on this lease.

A new gas sand has been indicated in the old part of the Alta Mesa field by Standard of Texas' Mestena A-24, which made a drill stem test at 5010-36 feet, using ¼-inch chokes at top and bottom, showing a working pressure at surface of 900 pounds in 18 minutes and was then shut in. It is now drilling.

Jim Hogg County: F. B. Lefevre's A. Martinez 1, wildcat 12 miles southeast of Hebbronville in the Las Animas Grant Block 91, is plugged back from 1850 to 1450 feet to sidetrack and redrill a sand which showed saturation while being cored. A 7-minute drill stem test at 1750-56 feet showed 150 pounds working pressure but no fluid, and a test was then made at 1774-80 feet which recovered 882 feet of fluid, 122 feet of which was oily mud with the remainder salt water.

S. F. Hurlburt and Gulf States Oil Company have made location for their J. Vela Pena 1, 3500-foot wildcat test 25 miles south of Hebbronville in Block 10, E. L. Peyote Grant.

Duval County: J. W. Gorman has made location for A. Herbst 5, 1320 feet northeast of the Herbst 2 discovery well, Herbst field.

Two failures were recorded in Duval County when Fred W. Shield abandoned his Altha G. Black in the area 3 miles north of Chiltipin field at 5000 feet after showing nothing on electric logging survey.

Cox & Hamon et al's Clara Driscoll 2, Sec. 44, Santa Rosalia Grant, has been abandoned at 2467 feet.

Jackson County: Sinclair Prairie Oil Company's John Atkinson 1, outpost in the Texana area, has been completed as a gas-condensate well, flowing from perforations at 5505-08 feet. No gauge has been taken, but the well showed pressure of 2075 pounds while flowing through a ⅛-inch choke. Total depth is 7807 feet with the casing set to 6878 feet.

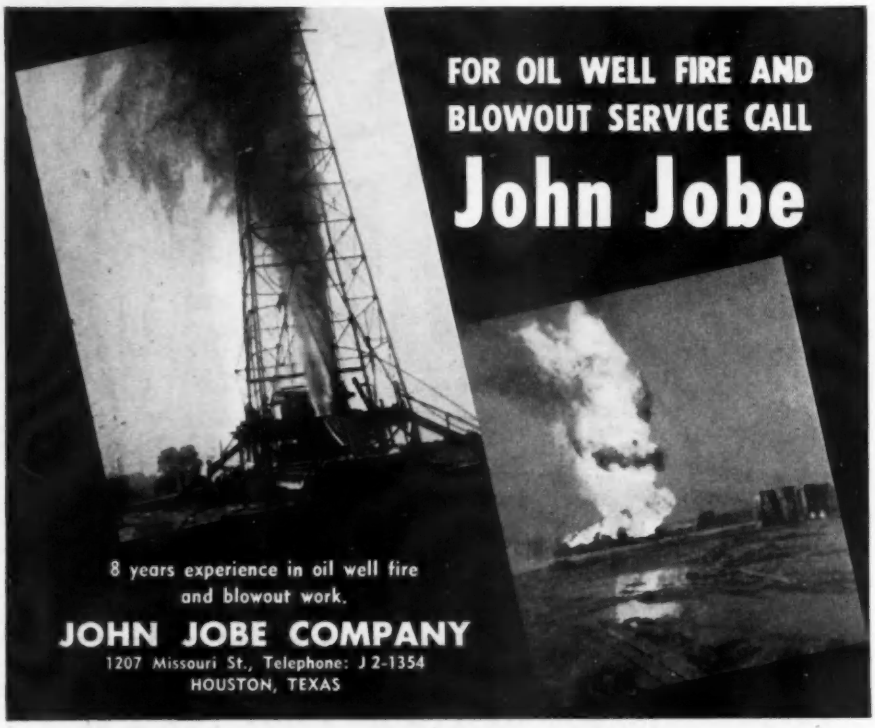
Humble Oil & Refining Company has made location for Four Way Ranch Company C-1, wildcat southeast of the North LaWard field and south of the Maurbo field.

Humble's Clements 1, wildcat in the El Toro area, western Jackson County, is drilling below 6480 feet in sand and lime.

Magnolia Petroleum Company's West Ranch A-266, Vicksburg test in the West Ranch field, is shut down for orders after running electric log to 8520 feet.

Subsidy Payments Granted For More Oklahoma Fields

Directives by the Defense Supplies Corporation added a number of Oklahoma stripper oil fields to the list eligible for subsidy oil payments. Effective September 1, a 20-cents per barrel subsidy was set for wells producing from the Cromwell, Gilcrease, Hunton and Upper Simpson zones in the Fitts area of Pontotoc County, although the order directed that production from the Wilcox and other zones be segregated. Effective October 1, the following subsidies were announced: Billings—shallow, 35 cents; Billings—siliceous, 20 cents; Cement-Fortuna, 35 cents; West Earlsboro, 25 cents; South Edgewood (Osage County), 35 cents; Fish-Booch, 35 cents; Northeast Henryetta, 35 cents; Jackson (Seminole County), 20 cents; Megratomoie (Osage), 35 cents; Paden, 35 cents; Pettiquah (Osage), 35 cents; Platter, 35 cents; Reed (Garfield County), 25 cents; Rosana, 20 cents; Sams-Oswego (Noble County), 35 cents; Sams-Pennsylvanian, 35 cents; Southwest Romulus, 20 cents; Traugh, 20 cents.



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1—13⅜" Cameron 3000 lbs. test, fluid closed, manual opened, mounted on steel skids, all connections, 4½" rams and 13⅜" Hughes master valve, 3000 lbs. test.
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Texas Gulf Coast

New Gas-Distillate Field Opened in Hardin County

Houston Oil Company of Texas and American Republics Corporation have opened a gas-condensate field for Hardin County, 5 miles south of Warren, with their Hardin County School Land Fee 1, now shut in awaiting potential test. Drilled to 7006 feet, it was plugged back to complete in the upper Cockfield sand, perforating casing at 5796-5807 feet in a sand which had shown gas and condensate on a drill stem test. It cleaned itself through a ⅛-inch choke, making gas and condensate with no salt water, and was then shut in.

Wharton County: General Crude Oil Company's Security Bank & Trust Company 2, in Lane City area, just north of the Magnet field, is still testing after having recovered oil and salt water on the latest drill stem test, with casing perforated at 5445-53 feet. It is preparing to squeeze off these perforations and will re-perforate in the same sand for the next test.

General Crude has made location for Security Bank & Trust Company 3, in the same area, 1000 feet west of the well now being tested, and on the same lease in the S. Castleman Survey. It will drill to 5500 feet to the same formation.

Drilling & Exploration Company's Gresham 1, wildcat 2½ miles northwest of Hillje, has been abandoned at 6015 feet with no showings reported. It was drilled and abandoned in just 16 days.

Montgomery County: George W. Strake's W-1 Krohn, Wilcox test in the Conroe field, is coming out of the hole to put on a core barrel and start coring at 9247 feet. It plans to core to 9350 feet and then run another electric logging survey. There have been no showings in the Wilcox other than a slight showing in the top.

Pan American Production Company's Posey 1, Pinehurst area, is drilling below 9760 feet in shale and sand, in the Wilcox also but with no real showings.

Hardin County: Sun Oil Company's Merchant Estate 1, deep test in the Sour Lake area, was drilled to 8497 feet and is setting a string of 5½-inch production pipe after running electric log to bottom. No details of showings have been reported.

Harris County: Glenn H. McCarthy's Reichert 1, outpost a mile west of the discovery well in the Spring field, northern Harris County, is drilling below 6600 feet in shale. It failed to find shows in the Cockfield formation from which the Eltex well is producing.

Colorado County: Pan American Production Company has made location for a wildcat 2¼ miles northeasterly from Cities Service Oil Company's Poole 1, which recently extended the Ramsey field as a good gas-distillate producer from the Wilcox sand. Pan American's well will be R. L. Williams 1, on a 1297.5-acre lease in Survey 663, 8 miles west of the town of Eagle Lake.

Tide Water Associated Oil Company's Underwood 1, wildcat 3½ miles northwest of Sheridan, western part of the county, is awaiting cement after making two squeeze jobs prior to making the final production test where it is expected to produce gas and distillate. Total depth is 9990 feet with the casing landed at 9962 feet.

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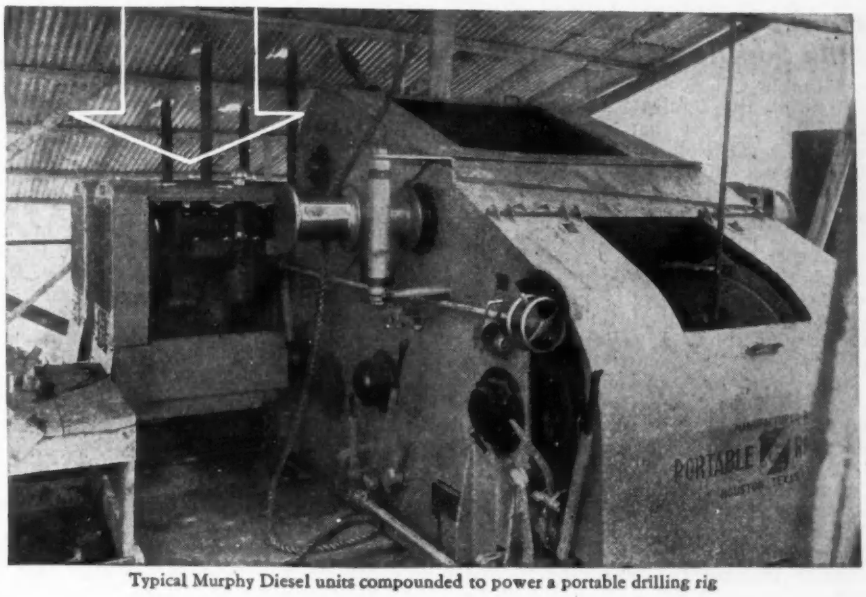

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South Louisiana

Laurel Ridge Field Gets Mile Southeast Extension

Humble Oil & Refining Company is extending the Laurel Ridge field, Iberville Parish, more than a mile southeast with its C. G. Robinson 1, which is now being tested through a small choke but is showing a little salty or brackish water while cleaning. It had perforated casing at 10,551-553 feet for this test, apparently in a sand above the one from which the discovery well produces, and was cleaning itself into the pits at the close of the week through a ⅛-inch choke and showing tubing pressure of 1475 pounds. It is now making an unestimated amount of fluid which is 55 percent oil, 35 percent wash water and mud, and 10 percent emulsion which is partly brackish. Total depth is 10,710 feet with casing set on bottom.

Acadia Parish: The Texas Company has made location for its American Rice Milling Company 1, Egan field area. Location will be in the southwest corner of 28-9s-1w, and it is scheduled to 11,000 feet.

Humble's M. L. Vincent, Jr. B-1, North Tepetate area, perforated casing at 9029-37 feet for a production test, but swabbed to 6000 feet with no results and is pulling tubing to squeeze and reperforate for another test.

Union Sulphur Company has made location for its Medlenka 1, new wildcat in the Iota area, located in approximately the center of 11-8s-2w, 4 miles northwest of the Iota townsite.

Continental Oil Company is spudding Mrs. L. D. Thibodeaux 1 in the Church Point area which is to be drilled to 9500 feet.

Calcasieu Parish: Continental Oil Company's Greathouse 1, attempting to open a new field on the South Lake Charles prospect, is perforating again for a test in the 10,900-foot sand after having squeezed off the previous perforations where it showed salt water. Total depth is 11,019 feet.

Jefferson Davis Parish: Barnsdall Oil Company et al are preparing to start work in their P. & M. D. Miller, in the new Panchoville field, offsetting the discovery well. The discovery flowed 793.8 barrels of oil daily through a ¼-inch choke from perforatiois at 8516-28 feet.

Vermilion Parish: The Pure Oil Company is preparing to start testing its Ferguson-Benoit Unit 1, on the southeast flank of the West Gueydan dome, after perforating the 5½-inch casing. Total depth was 10,806 feet with casing set at bottom with perforations scheduled below 10,750 feet.

Union Oil Company of California's State-White Lake B-1, ¾ mile southeast of the discovery well, West White Lake field, is drilling at 10,816 feet.

LaFourche Parish: The Atlantic Refining Company has made location for Bowie Lumber Company 1, deep wildcat to be drilled in the Kraemer area in 7-14s-18e to 12,000 feet.

☆

H. W. PENTERMAN, head of the land department for the Mid-Continent area, Shell Oil Company, Tulsa, has been named acting vice president in the absence of Ralph B. Roark.

North Louisiana

Tremont Area Discovery Receives Its Initial Test

The California Company has made its first test on the new discovery in the Tremont area, southeast Lincoln Parish. Based on a 4-hour test with casing perforated with 120 holes at 9060-80 feet, the well flowed 97 barrels of 55-gravity distillate daily and 2,235,000 cubic feet of gas daily, testing through a ⅛-inch choke on tubing, with pressure of 4100 pounds. Separator pressure showed 400 pounds while the well was flowing through a ¼-inch choke. When closed in the well showed pressure of 4200 pounds.

Bossier Parish. Barnsdall Oil Company and Sohio Petroleum Company's J. T. Hanks 1, recently completed to open a new field for Bossier Parish, producing from the "D" sand, Cotton Valley, is installing heaters preparatory to starting the initial test. On previous tests it made 7.7 barrels of high-gravity distillate per hour but had trouble with flow lines freezing.

Claiborne Parish: Ohio Oil Company's P-1 Taylor, Haynesville field, is still testing from the deep horizon after perforating casing at 9905-20 feet, 10,200-210 feet, 10,310-315 feet, and 10,373-395 feet, having first shown distillate at the rate of 6.96 barrels in 20 hours, through a 16/64-inch choke with tubing pressure 475 pounds and only 325,000 cubic feet of gas per day showing.

LaSalle Parish: The Atlantic Refining Company's W. T. Hardtner 1, in 3-10n-2e, northeast of Urania, drilled to 3993 feet in shale, scheduled to go to

Interesting Figures

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Arkansas

4100 feet for a Wilcox test. It had drilled Wilcox since 1568 feet, but an electric log to 2600 feet failed to show signs of oil or gas, and the well is being abandoned.

Webster Parish: Phillips Petroleum Company's Docia 1, 8500-foot wildcat several miles south of the Shongaloo area, is drilling below 6061 feet in shale with nothing showing thus far in the Travis Peak.

Ohio Oil Company et al's Pardee 1 Acct. 1, north of the Cotton Valley field, will be a deep test in the new North Cotton Valley area recently opened, and will be located in 36-22n-9w.

Concordia Parish: The California Company has completed another well in the Lake St. John field, with its Lawrence Allwood 1 flowing 336 barrels daily through a 5/32-inch choke with tubing pressure 1875 pounds. Casing was perforated at 9078-9108 feet.

Union County Test Slated To Open Producing Area

Root Petroleum Company is due to open a new producing area in Union County with its Union Saw Mill Company 1, Strong area, but probably will have trouble getting water and oil separated. It made a drill stem test at 6338-53 feet, using ¼-inch chokes at top and bottom, and recovered 900 feet of pipe line oil and 900 feet of salt water in 14 minutes. Electric log indicated top of the Buckner at 6268 feet and top of Smackover at 6308 feet with best porosity at 6330-47 feet. Oil and water was indicated from 6347-82 feet, total depth. 5½-inch casing has been set to 6363 feet and squeeze jobs will be made to try to shut off water before completing.

Ouachita County: Grady H. Vaughn's J. F. Haltom 1, wildcat in 28-15s-18w, several miles east of the Stephens field, has bailed a small amount of heavy oil and considerable salt water after perforating in the Tokio zone at 2475-85 feet. The well probably could be completed as a small pumper at this point. Oil is black with gravity about 15 degrees. The well may plug back still further for tests in the Buckrange and Nacatosh zones, where showings of gas were logged while the well was drilling. Previous tests in the Travis Peak at 3673½-76½ feet and in the Glen Rose at 2988-95 recovered salt water.

Skelly Oil Company has abandoned its Pate 1 in Sec. 9, 14-17w, after drilling to 4350 feet. It had found some porosity at 4290 feet but a drill stem test showed salt water. Top of the Smackover was picked up at 4290 feet.

Hempstead County: Barnsdall Oil Company and Sohio Petroleum Company's M. Cox 1, in 2-14s-26w, ran electric log to 5254 feet in the Smackover lime but apparently has not shown any oil or gas. Cores at 5203-13 feet in the Smackover recovered oolitic lime, fairly porous, but with no shows. There have been reports that some shows were found in the Cotton Valley. The well was then drilled to 5412 feet and is being abandoned.

Pope County: Stanolind Oil & Gas Company's G. B. Maxwell 1, cable tool well in northern Arkansas, has reached 4080 feet and was fishing for bailer. It is scheduled to the Arbuckle lime.

Johnson County: Arkansas-Louisiana Gas Company's S. M. Hudson 1, scheduled Arbuckle lime deep test in the Clarksville pool, is drilling below 6096 feet in hard dry sand in the Simpson with no showings found to this depth, which is the deepest a well has yet gone in the area.

Stephens Field: Relaxation of spacing regulations to allow 10-acre drilling is believed responsible for a new of new locations in the Stephens field. Four new locations were made in the area in a week, three of which will be in the Columbia County portion of the field and one in Ouachita County. R. H. Crow will drill two wells, while G. H. Vaughn and T. W. Lee will drill one each.

Southeastern

Jefferson Davis Wildcat May Produce from Eutaw

Gulf Oil Corporation's D. L. Mullins 1, wildcat southwest of the Gwinville discovery in Jefferson Davis County, Mississippi, indicated possibility of gas and distillate production from the Eutaw after making a drill-stem test, and is coring below 8180 feet in shale after getting other shows. The first test was made at 8020-50 feet after indications on electric log showed gas in sand at 8000-34 feet, and showed a blow of gas at the

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surface estimated good for at least 6,000,000 cubic feet daily, in addition to recovery of 100 feet of amber-colored distillate. Gulf then cored additional sand showing gas and distillate at 8167-76 feet, but did not make a drill-stem test. It is planned to go through the Massive sand section in the Tuscaloosa before stopping for a completion. The Sid Richardson discovery at Gwinville was completed in the Tuscaloosa, having found the sand in the Eutaw too low on formation to complete without making water also.

Lamar County: Gulf Oil Corporation's Cooper 1, Baxterville area, southwestern Lamar County, is coring below 9030 feet with no further showings reported since making the test at 8835 feet that recovered 3000 feet of oil. Core analysis in this well reveals sand showing oil from 8723 to 8839 feet, a 116-foot section in the Tuscaloosa.

Sinclair-Wyoming Oil Company's Newman Lumber Company 3, northeast corner of the county, is drilling below 5550 feet in shale, making good time on a 10,000-foot contract.

Shell Oil Company's Hibernia Bank & Trust Company 1, on the flank of the Tatum dome, is drilling below 7450 feet in sand and shale, now in the Tuscaloosa which was topped at 7034 feet, but no showings have been found.

Adams County: The Pure Oil Company's McDowell 2, wildcat in the western part of the county, is drilling below 10,800 feet in shale with no indications by the company as to just how much deeper it is to be carried before coming back to attempt completion at 10,300 feet, where casing had already been set. Humble Oil & Refining Company's Mrs. Ida Stowers A-1, northern part of Adams County, is drilling below 10,400 feet.

Copiah County: Joe B. White & Big West Drilling Company's Magnolia Textiles 1, wildcat in the southern part of Copiah County, is pulling a core from 10,135 feet after having recovered sand with no showing in a core from 10,126-135 feet.

Claiborne County: Sohio Petroleum Company's Georgiana Mackey 1, wildcat near the south line of the county, is coring and drilling at 8444 feet in chalk after topping the Selma at 7980 feet.

Sun Oil Company's Hammett A-1, Bruinsburg area, is preparing to drill after failure to find showings in a core from 1970-80 feet.

Lauderdale County: Mid-Southern Drilling Corporation, new firm headed by H. H. Hamilton, has made location for Bunnie Jene Clark 1, wildcat in 13-8n-17e, 12 miles northeast of Meridian and contracted to go deep enough to prospect the Marine Tuscaloosa.

Providence Drilling Company's Flintkote 1, northeast corner of the county, is awaiting cement after a squeeze job on perforations at 2440-58 feet, where it recovered salt water on a test. Total depth is 3005 feet with casing set on bottom, after topping Tuscaloosa at 2898 feet.

Alabama

W. O. Woodward, Trustee's Mary Green 1, in 31-11n-4w, northwest extension area to the Gilbertown field, Choctaw County, is preparing to set casing for a test of showings found in drilling to total depth of 3708 feet. Showings had been reported in the Eutaw and Selma series. This well has been carried as a wildcat but is in the area just north of a line between Hunt's Land 2 and Scruggs 1, recent completions believed to be on structure with the Gilbertown discovery.

Roland, Hamilton & Jarvis have started building roads to drill their Dr. J. W. Rudder 1, another Choctaw County wildcat in 7-11n-3w, 6 miles north of production in the Gilbertown field. It will go to 3800 feet to test the formations yielding showings at Gilbertown.

Washington County: The Texas Company's N. S. Stallworth & Company 1, wildcat in the southern part of Washington County, is drilling below 7366 feet with no details reported on formations.

Florida

The Pure Oil Company's C. C. Hopkins 1, wildcat in 21-6s-9e, Gulf County, is drilling below 6368 feet in shale.

In Collier County, Humble Oil & Refining Company's Gulf Coast Realties Company 4, third test for the Sunniland area, is mixing mud and preparing to spud.

Humble's Gulf Coast Royalties 3 has completed building roads but has not moved in equipment.

Humble's State 1, Dade County, is drilling at 7680 feet in lime.

In Leon County, Stanolind Oil & Gas Company's St. Joe Paper Company A-1 is coring below 3957 feet.

☆

W. W. (RED) POWERS has been named state representative for Louisiana for Texas Iron Works, Houston. He will headquarter in Houma.

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Rocky Mountain Area

Crooks Gap Structure Test Produces from Dakota Sand

Sinclair-Wyoming Oil Company has a Dakota sand producer in its State 1, NW SW NW 18-28n-92w, Crooks Gap structure, Fremont County, Wyoming. The well drilled into the Dakota at 5234 feet and a core taken at 5244-5248 feet, total depth, showed 3 feet of saturated sand. On 32-minute drill-stem test at 5234-5248 feet, it flowed at a 50-barrel per hour rate with a flowing pressure of 1800 pounds and shut-in pressure of 2600 pounds. The oil is 37.1 gravity.

Crooks Gap is a small faulted elongated dome with Steele and Niobrara shale on the surface. State 1 is the first well on the structure to test the lower horizons.

North Big Hollow: Production was found in the Muddy sand at 827-848 feet by Oklahoma Oil Company in the North Big Hollow district, Albany County, Wyoming. The well, Union-Pacific-Fuller 1, C NE NW 7-15n-75w, swabbed at the rate of 6 barrels of approximately 22-gravity oil per hour. Due to lack of storage, the well was not adequately tested, but is estimated good for about 65 barrels per day. Union-Pacific 2, a direct west offset, NW NE NW 7-15n-75w, is spudding.

Home Coal Users to Be Permitted Change to Oil

With fuel oil supplies in the East and Middle West running above rationed demand, PAW last week disclosed that it had recommended that fuel-oil consumers who had converted to coal be permitted to return to the use of oil and OPA announced that regulations to that end would be issued about November 1.

The change in regulations will apply only to home consumers, but users of residual oil—hotels, office buildings and apartment houses—also are to be given increases in rations sufficient to allow normal consumption.

It was emphasized, however, that the improvement in the distillate situation, while sufficient to provide the 10,000 barrels of oil daily estimated as required for reconversions, does not permit any increase in the current rations of homeowners generally.

Illinois Basin

Franklin County Wildcats Hold Interest in Illinois

Franklin County's 3 wildcat tests, which promise to become discoveries, are the center of interest in Illinois.

Probably most outstanding is Deep Rock Oil Corporation's Kirk 1, NE SE SE 15-7s-4e, 2 miles north of the Thompsonville pool. Operators are waiting on cement after setting pipe for a test of Aux Vases sand at 3715-35 feet. During a 1½-hour drill-stem test, the well showed 900 feet of oil and 150 feet of oil-cut mud.

Near the town of Thompsonville, 2 miles from nearest production, Central Pipe Line Company's Rose 1, SE NE SE 4-5s-3e, is waiting on cement after showing 1230 feet of oil and 60 feet of oil-cut mud during a drill-stem test of McClosky lime at 2973-79 feet. The well made gas in 6 minutes.

Two miles southeast of Sesser, Sam Jarvis' Old Ben Coal Company 1, SE NE SE 29-5s-2e, is waiting on cement after setting pipe to test O'Hara lime at 2826-58 feet. The well yielded 220 feet of oil and 180 feet of oil-cut mud during a drill-stem test.

Coles County: The Mattoon pool of Coles County is drawing great interest, chiefly because it looks as if it will pay off after many failures in the general area, and because it is located on one of the structures which geologists for several years termed outstanding. After extending the pool, Carroll and Burgett have pipe set at Rudy 2, SE SW SW 24-12n-7e, for a test of Rosiclare lime at 1990-2000 feet, and are drilling below 700 feet at Rudy 3, NE SW SW 24-12n-7e. Anthony Keating is preparing to drill Uphoff 2, NE NW NW 25-12n-7e, south offset to Rudy 2, and north offset to Uphoff 1.

Douglas County: Ohio Oil Company's Shaw 1, SW SW SW 36-16n-8e, wildcat on the LaSalle anticline, is drilling below 3500 feet, headed for 6000.

Richland County: Fulk and Cravens' Martin Heirs 1, SW NE NE 24-3n-8e, has been completed, flowing 470 barrels in 24 hours from McClosky lime. Total depth is 2005 feet.

Hamilton County: The Texas Company was drilling below 4500 feet at Davis 14, SE NW NE 7-6s-7e, in quest of the Devonian lime for the first time in the Dale pool.

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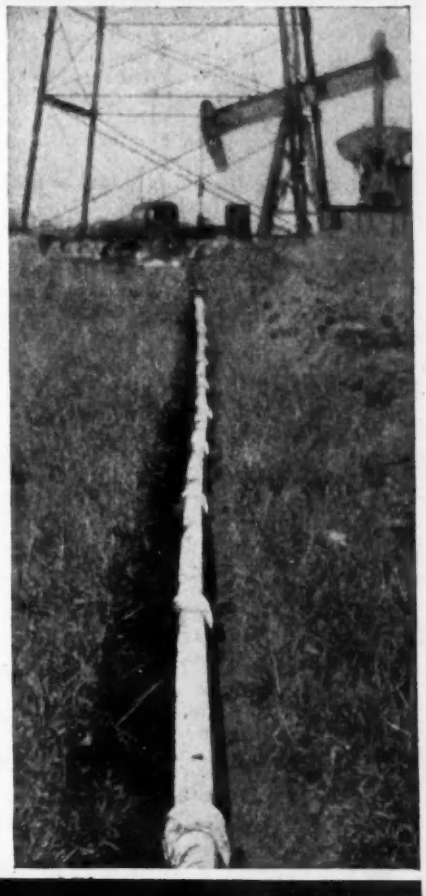

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Michigan

Ogemaw Well Is Probable New Horizon Discovery

Muskegon Development Company's State A3, NW NE NW 29-24n-2e, Rose City field, Ogemaw County, flowed 250 barrels of oil in 8 hours from Traverse limestone pay at 2046-54 feet for a probable new horizon discovery in the field, which was discovered in 1942 with a Richfield lime well at approximately 4200 feet. The upper formations did not carry commercial oil in the discovery or in the 3 other deep wells drilled since.

Montcalm County: First test to be drilled below the Traverse lime (2600-2700 feet) discovery horizon, C. L. Maguire, Inc.'s Bogert 1, SE NE SE 31-9n-5w, Bloomer field, was cased at 3265 feet preparatory to testing 2 possible pay zones in the Dundee-Monroe sections. Dundee lime was logged at 3046 feet with saturation at 3046-48 feet. Water was logged at 3082 feet and a possible pay at 3186-96 feet in the Monroe.

Air and Gas Injection Methods Are Described

Practical and expedient air and gas-injection methods for increasing the oil production rates from partly-depleted pools of the Appalachian fields are proving successful as a wartime measure to help ease the burden of the nation's major flush petroleum fields, Dr. R. R. Savers, director of the Bureau of Mines, revealed October 3, in releasing a report written by Bureau engineers in that area.

Copy of the report, Report of Investigations 3777, "Wartime Application of Air-Gas Injection and Oil-Well Reconditioning in the Appalachian Region," is available without charge, from the United States Bureau of Mines, Department of the Interior, Washington, D. C.

Needville Field Rules

The Texas Railroad Commission's operating rules for the new Needville field, Fort Bend County, provides wells spaced 330 feet from lease lines and 800 feet apart. Proration is on acreage and per well, with 75 percent on the former and 25 percent on the latter factor. Forty-acre proration units are provided.

Sohio Gets Towboat

Last of a fleet of 21 steel river towboats built under an ODT-sponsored program was delivered October 23 to the Sohio Petroleum Company at St. Louis, to be used for towing barges of petroleum and products on the Mississippi and Ohio rivers.

WESTERN CANADA

Development Planned if Princess Producer Holds

If further tests on Standard Oil Company of California's Princess Corporation 8 in the Princess oil and gas field of Alberta prove successful, an enlarged development program for the area may be undertaken. According to a company announcement, all available storage is filled and production is shut in pending repairs to loading facilities at Princess, 3 miles away. The well, 110 miles southeast of Calgary, tested as follows: In a four-week run through a number of restricted openings, 4824 barrels of 34.5 gravity crude were recovered, indicating an optimum production rate of between 200 and 250 barrels daily, through 11/64-inch choke. At this rate there was no apparent decline in pressure, and the gas-oil ratio was 635. A water content of 1.35 percent was present, but it is believed that some drilling fluid was responsible for part of the water. Production is from Devonian Lime at 3982 feet. As soon as facilities are ready, a third day production test is planned.

Empire Petroleums, Ltd., is starting its initial well in the general Princess area where it has acquired 9000 acres of prospective leases, Empire Petroleums' 1, in the center of the northeast 10-acres of Lsd 7, 11-19-11w4th, 11 miles southeast of Standard of California's Princess 8.

In the Conrad area, southern Alberta, Standard has made location for two tests, an offset extension and a wildcat. The offset extension is Conrad-Province No. 55-33B, near the center of the southeast 10 acres of Lsd 11, 33-5-15w4th, ⅜ mile southeast of Conrad Province 77-33B, recently completed at 3079½ feet, 13½ feet in the Ellis sand, and now installing pump for production. The test is also ¾ of a mile southeast of the discovery, Conrad-Province 2, which is pumping 120 barrels daily. The wildcat is Conrad-Province 55-21B, near the center of the southeast 10 acres of Lsd 11, 21-5-15w4th, 2 miles south of 55-33B.

On the northwest flank of Turner Valley, Standard is staking a location for Royalite-Lowery 2 to test prospects of the 1½ mile long blank section.

Initial wildcat test west of the Lloydminster area has been spudded by Lloydminster Oil Producers, Ltd., 5½ miles west and north of the Sparky 1 and 2, most westerly producers in the field. Lloydminster Oil Producers No. 1 is in the southwest 10 acres of Lsd 12, 10-50-2w4th.

Thorough Exploration for Oil in Saskatchewan

The province of Saskatchewan in Canada is currently undergoing a thorough exploration effort as Imperial Oil Limited pushes its program of surveying and drilling. Over the period from 1939 to 1943 inclusive, an area of more than 20½ million acres was checked geologically and core drilled, and the effort still goes along briskly. Three instrument and geological parties and core-drill crews are active in the territory immediately north of Montana and North Dakota, trying to answer the question of Saskatchewan's oil possibilities.

Unusual problems confronting the searchers are suggested in the fall issue *Imperial Oil Review*, 1944. "In Saskatchewan," the report says, "the geologist's complaint is not that nature misleads him; she more or less ignores him. These same processes which gave us the 'Good Earch' and made the Prairie Provinces the 'Bread Basket of the World,' heaped such an overburden of soil, clay, gravel and assorted detritus over the landscape, and to such depths that a geologist is practically denied the makings of a deduction, good, bad or indifferent, and the scant exposures of rock, in situ, are merely an aggravation. An occasional stream may get down to bed-rock; an isolated bluff may furnish a section, but the geologist who tries to reconstruct the underlying picture of Saskatchewan purely by masses of rock, outcroppings and without the assistance of the core drill, seismic instruments or other remote control tools, is akin to the Israelite making bricks without straw."

Conditions Favorable

Between 1939 and May, 1942, the work was confined to surveys and core drilling and represented an examination of over 54,600 square miles. A number of structural conditions favorable for the accumulation of oil was revealed.

The provincial government took steps, late in 1940, to encourage the risk of capital for extensive oil search and also to insure efficient and scientific development of any fields found. The government withdrew from ordinary leasing procedure a vast area of land in the southern part of the province and provided "that any interests willing to risk the large amounts of capital needed for detailed geological study, geophysical work and drilling could make a sizeable reservation in the area and in consideration of their work and capital expenditures could within three years lease areas that were considered desirable."

Norcanols Oil and Gas Limited was among the first of the companies to respond. Shareholders in this company include the Canadian Western Natural Gas, Light, Heat and Power Limited; Security Assets Limited; Osler, Hammond, and Nanton Limited; and Consumers' Co-operative Refineries Limited. Imperial Oil Limited subscribed the largest part of the capital, and subsequently entered on its own account, the search for oil in the southern part of the province.

Of approximately 12½ million acres held by the two companies, approximately 93 percent is represented by Crown reservations. The balance was leased from or is reserved by private interests.

Several Dry Holes

With the drilling of Radville 1, in May, 1942, by Norcanols, testing was begun. Rotary equipment was used. Extensive coring was done so that no promising horizon would be undetected. In spite of some oil saturation, the well was ultimately abandoned in January, 1943, at 7958 feet. Four other Norcanols wells have been completed, all of them dry. Imperial has also completed two dry holes. "In no instance," the report says, "was production obtained, although there were, in some cases, indications which encourage drillers to keep trying."

Geological and core-drilling parties operate at an approximate cost of 1¼ cents per acre; gravity meter surveys run about ½ cent per acre, while seismic work jumps to around 7 cents. Drilling and coring amounts to approximately $29 per foot.

To date, the balance sheet for Saskatchewan is about as follows:

Area geologically surveyed and core drilled (1939-1943), 20,797,440 acres.

Area surveyed by gravity meter (1940-1941), 10,897,920 acres.

Area surveyed by seismograph (1940-1943), 5,091,840 acres.

Seven deep tests drilled by rotary, a total of 49,600 feet.

U. S. Exploratory Completions

ALABAMA WILDCATS

Escambia County—Failure: Hunt Oil Co.'s Harry B. Jones Tr. 1, 146 ft w & 170 fe s of cent se se sect 3-1n-11e, abnd 7732 ft.

Washington County—Failure: Humble Oil & Refining Co.'s J. R. Williams et al B-1, cent sw nw sect 20-6n-4w, salt water on dst 5814-32 and 6295-6330 ft, abnd 6547 ft.

ARKANSAS WILDCATS

Ouachita County—Failures: Skelly's L. T. Pate 1, se sw ne 9-14s-17w, elev 189 ft, Travis Peak 2475 ft, Smackover 4290 ft, porosity 4295 ft, abnd 4350 ft.

Wampler Bros.' J. B. Morgan 2, sw nw sw 16-15s-19w, abnd 2220 ft.

CALIFORNIA WILDCATS

Fresno County—Failure: Superior Oil Co.'s Hanneman 83-30 se ne 30-15-17, abnd 7351 ft.

Kern County — Failures: Continental Oil Co.'s KCL-G2, nw ne 4-30-26, top gray sand 7702 ft, abnd 7746 ft.

General Pet. Corp.'s Larkins 1, ne ne 10-28-28, (Round Mountain area) top gray Vedder 2765 ft, abnd 10-20-44, depth 3029 ft.

North American Oil Cons.' 28-23, sw nw 28-31-23, Upper Calitroleum 3290-3424, gray, abnd 10-17-44, depth 3719 ft.

Los Angeles County—Failure: Richfield Oil Corp.'s Leuzinger 1, sw sw 83-14, abnd 10-20-44, depth 4582 ft.

San Diego County—Failure: La Jolla Pet. Co.'s La Jolla 1, 32-15-3, San Diego Pueblo Lot 1238, top Pliocene 1100, top Eocene 2310, top Poway congl 2820, top Cretaceous 3210, top basement 3720, abnd 10-23-44, depth 3750 ft.

COLORADO WILDCAT

Archuleta County—Failure: L. R. Travis, Federal 1, ne nw nw 35-36n-1w, Pagosa Springs, wtr in Dakota, abnd 2035 ft.

ILLINOIS WILDCATS

Effingham County—Failure: Shulman Bros. et al's Loveless 1, nw ne sw 20-8n-4e, abnd 1782 ft.

Fayette County—Failure: Deep Rock's Albert 1, se se nw 33-5n-1e, abnd 1877 ft.

Franklin County—Failure: Aetna Oil's U. S. Coal & Coke 2, sw sw ne 29-6s-4e, abnd 3171 ft.

Jefferson County — Failure: Deep Rock's Interstate Coal 1, se sw nw 4-4s-1e, abnd 2984 ft.

Wayne County—Failure: A. J. Hammer et al's Williams 1, sw nw se 3-2s-9e, abnd 3476 ft.

White County — Failure: Amisco, Inc.'s Austin 1, ne ne sw 28-6s-9e, abnd 3225 ft.

INDIANA WILDCAT

Jefferson County—Failure: W. W. Copeland's Fee 2, sw nw 9-4n-9e, abnd 131 ft.

KANSAS WILDCATS

Barber County—Failure: Texas Co.'s Groendyke 1, sw sw se 27-33s-12w, Miss 4677 ft, Arb 5318 ft, abnd 5320 ft.

Cowley County—Failure: Texas Co.'s Wahlenmaier 1, ne ne nw 13-34s-4e, Bart 3190 ft, Miss 3253 ft, Simp 3712 ft, Arb 3721 ft, abnd 3836 ft.

Jefferson County—Failure: Dan McLaughlin's Bk of McLouth 1, ne se ne 17-10s-20e, Miss 1580 ft, abnd 1724 ft.

McPherson County — Failure: May Pet.'s Decker 1, sec 11-20s-3w, Lans 2382 ft, abnd 2970 ft.

Pratt County—Failure: Superior's Patterson 1, se se sw 16-28s-13w, Miss 4340 ft, Arb 4584 ft, abnd 4654 ft.

Pratt County — Oil Discovery: Skelly's Shriver 1, nec 33-29s-14w, flow 344 bbls oil day, shot 15 qts 4557-61 ft, Simp sd, td 4679 ft.

Reno County—Failure: Continental et al's Hodge 1, ne ne sw 15-22s-8w, Hunton 3515 ft, Vi 3649 ft, Simp 3684 ft, abnd 3808 ft.

Rice County—Failure: Ben Hyde's Hammel 1, cel ne 16-19s-10w, KC 2966 ft, abnd 3081 ft.

Rice County—Failure: Lauck & Moncrief's Sieverburg 1, nw sw se 17-19s-10w, Arb 3332 ft, abnd 3348 ft.

Saline County—Failure: Phillips' Ryan 1, ne ne se 17-14s-1w, Arb 3412 ft, abnd 3568 ft.

Sumner County—Failure: Bay Pet.'s Dennett 1, nec sw 23-33s-3w, Miss 4092 ft, Simp 4510 ft, abnd 4515 ft.

KENTUCKY WILDCATS

Hopkins County — Failure: Hunt et al's Whitfield 1, 1-K-25, abnd 232 ft.

McLean County—Failure: Miller & Shiarella's Frey 1, 3-M-29, abnd 2232 ft.

MICHIGAN WILDCATS

Arenac County—Failure: R. L. Barr's Wojtowicz 1, c nw 27-19n-4e, abnd 150 ft.

Ionia County—Failure: C. L. Maguire, Inc.'s St. Clair 1, s½ nw se 28-8n-5w, Dundee 2946 ft, abnd 3034 ft.

Isabella County — Failure: Chartiers Oil Co.'s Kirkconnell 1, n½ nw sw 2-13n-3w, Dundee 3612 ft, abnd 3645 ft. Allegan Pipe & Supply Co.'s Duffy 1, se ne se 27-13n-4w, abnd 3599 ft.

Sanilac County—Failure: Swan King Oil Co.'s Marshall 1, se ne nw 26-9n-15e, abnd 2502 ft.

MISSISSIPPI WILDCATS

Jasper County—Failure: Sinclair-Wyoming Oil Co.'s W. H. Clayton 1, sw sand recovered at 5155-67 and 5210-25 ft, td 6817 ft, abnd.

Lawrence County—Failure: Sinclair-Wyoming's Jefferson D. Riley 1, sect 14-9n-20w, top Massive 9810 ft, show salt water, abnd 10,613 ft.

Stone County—Failure: Harry I. Morgan's Wilbe Lumber Co. 1, sect 1-3s-11w, Massive sd 7980-8320 ft, abnd 8505 ft.

MISSOURI WILDCAT

Jackson County—Failure: Rafner Elevator Works' Fee 1, nec 4-59n-33w, abnd 820 ft.

MONTANA WILDCATS

Liberty County—Failures: Texas Co.'s Raabe 1, nw se se 19-34n-6e, Prescott blk, abnd in Madison 3200 ft.

Texas Co.'s Hanson 1, ne sw ne 21-33n-3w, West Utopia Block, top Madison 2108 ft, sulphur wtr, abnd 2110 ft.

Pondera County—Failure: R. C. Tarrant's Gehrig 1, nw sw se 31-28n-1w, Conrad-Midway area, lost hole, abnd 1720 ft.

OKLAHOMA WILDCATS

Kingfisher County—Failure: Davon Oil's McLaury 1, se ne ne 33-17n-5e, Bart 3481 ft, abnd 3510 ft.

Lincoln County — Oil Discovery: Sinclair Prairie's Danker 1, se nw se 28-14n-3e, flow 138 bbls oil day perf 81/3475-90 ft, Cleve sd, 52-gr, td 5346 ft, pb to 3528 ft.

Logan County—Gas Discovery: Cities Service's Gaffney 1, se ne 29-15n-4w, flow 10,800,000 ft gas daily, td 6980 ft, pb to Bart sd, perf 6420-97 ft, sl pres 2180 lbs.

Logan County—Oil-Gas Discovery: Eason Oil's Michael 1, 12-17n-4w, flow 90 bbls dist, 3,000,000 ft gas daily, shot 140 qts 4902-49 ft, Layton sd, td 4949 ft.

Marshall County—Failure: Cooper et al's Jacques 1, sw nw se 34-4n-5e, Crom 1093 ft, Caney 1840 ft, abnd 1860 ft.

Oklahoma County — Oil Discovery: Magnolia's Talbot 1, nw nw 28-13n-4w, flow 190 bbls oil hr ½-in ch perf 264/6970-7048 ft, Bois D'Arc, acid 1000 gals, td 7067 ft.

Osage County—Oil Discovery: Peters-Norbla's Osage 2, sw se nw 35-20n-11e, pump 50 bbls oil day 2420-50 ft, td 2520 ft.

Osage County—Failure: Mealy-Wolfe's Osage 1, nw sw ne 32-23n-6e, 2nd Wx 3202 ft, abnd 3220 ft.

Seminole County—Failure: Deep Rock et al's Jackson Est. 1, nw ne nw 21-7n-7e, Crom 3341 ft, Mayes 3990 ft, Vi 4316 ft, Wx 4448 ft, abnd 4453 ft.

WEST TEXAS WILDCATS

Crockett County—Failure: Standard Oil of Texas' University 1, c sw ne sec 5, blk 12, elev 2651 ft, abnd with hfw 2608 ft.

Culberson County—Failure: Humble's Reynolds Cattle Co. 1-B, c se nw PSL 33, blk 62, elev 5060 ft, base Capitan 1470 ft, top Delaware 1556 ft, abnd 5417 ft.

Hudspeth County — Failure: Schermerhorn Oil Corp.'s Tidwell 1, c se ne PSL 19, blk 74, abnd 935 ft.

Upton County—Failure: T.P. Coal & Oil Co.'s Morrison 1-A, c ne ne of C. & M. Ry. sec 29, elev 2607 ft, anhydrite 1365 ft, Yates sand 2185 ft, frosted grains 2215 ft, 1st lime 2995 ft, abnd 4101 ft.

Ward County—Oil Discovery: Lion Oil Ref. Co.'s University 1-B, c ne ne sec 43, blk 18, 3¾ mi e of Delaware gasser, elev 2655 ft, anhydrite 1010 ft, salt 1540 ft, Delaware lime 4940 ft, Delaware sand 4970 ft, flow 122 bbls 36-gr, gas-oil ratio 753/1, 24/64-in choke, shot 43 qts 4975-90 ft, td 4994 ft.

WEST CENTRAL TEXAS WILDCATS

Jones County — Failure: Onyx Ref. Co.'s West 1, 1100 ft nsl and 330 ft ewl labor 72, league 125, DeWitt CSL sur, elev 1791 ft, abnd 2375 ft.

Taylor County—Failure: Geochemical Surveys, Inc. et al's Haynes 1, 330 ft out nec lot 5, H. Sayles subdvn of n½ leag 122, W. R. Willis sur, elev 1836 ft, abnd 2490 ft.

SOUTHWEST TEXAS WILDCATS

Duval County—Failure: Taylor Ref. Co.'s A. Parr F-2, 1650 fr sl, 330 fr el, Sur 113, 360-ac lse, 6 mi sw San Diego, abnd 6040 ft.

Zapata County—Failure: Bridwell Oil Co.'s Amada C. de Garcia et al 1, 467 fr nel, 467 fr

BE SURE TO CHECK THE

Trading Post Section

ON PAGE 205 OF THIS ISSUE

ELECT

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sel 2211-ac lse, Charco Redondo Gr, sh C, abnd 1490 ft.

SOUTHWEST TEXAS OUTPOST

Starr County—Garcia Oil Extension: Sun's M. M. Garcia B-1, 1322.7 fr el, 467 fr sl 279-ac lse and tr D-1, Porc 94, sand 3906 ft, perf 48 shots 3908-16 ft, flow 86.3 bbls 47-gr, 9/64-in, td 4161 ft.

LOWER TEXAS COAST WILDCATS

Brooks County—Failure: Sun's J. D. Cage 6, 2230 fr wl, 467 fr nl TM RR sur 665, 3500 fr wl 23,219-ac lse, elev 198 ft, sw 6293-6300 ft, abnd 7577 ft.

Jim Wells County—Failure: Rodney Delange-Earl Rowe's S. McCarley 1, 660 fr nw& swl lot 6, blk A, Bode subdvn Wade Rch, on 100-ac lse, sand 4793 ft, abnd 4967 ft.

Refugio County — Oil Discovery: P. R. Rutherford's Smith-Crow 1, 467 e of Mission River line 467 n of sl 300-ac lse, Estevan Lopez Lge sect B&C, 8 mi s of Woodsboro, sand 4485 ft, perf 24 shots 5400-04 ft, flow 82.5 bbls 24-gr, ⅛-in, td 6505 ft.

Victoria County—Gas Discovery: Kingwood Oil Co.'s M. F. Bass A-1, 330 fr sel 990 fr swl 73-ac lse, 660 ne of Bass 1 blowout, lot 6, Rge 11, 4 Lge Gr, o&sw 4895-4903 ft, gas&s cond 4922-44 ft, gas 4724-27 ft, missed 2900-ft sd, perf 12 shots 4887-89 ft, flow 20 min gas, shut in, td 4957 ft.

TEXAS GULF COAST WILDCATS

Colorado County — Failure: Superior Oil Company's Matilda Tait 1, 2500 ft sw along sl of BBB&C Sur A-116 fr se cor thence 3330 fr nw at rt ang, abnd 10,350 ft.

Matagorda County—Failure: The Texas Co.'s C. G. Hamill 3, OWDD, 9 mi s of Sargent in Wm. Baxter sur, OTD 7500 ft had sw flow, drld deeper and abnd 12,512 ft.

EAST TEXAS BORDER COUNTIES OUTPOST

Panola County—Carthage extension: Skelly Oil Co.'s Houston Wells 1, 660 ft fr ne lines of 91-ac tr in M. A. Romero Survey, td 7001 ft, pb 6248 ft perf 6165-85 ft, ip 21,500,000 cu ft gas day open flow, had recovered sw on test of lower Pettit through perforations 6354-75 ft, 10 miles e of Carthage.

EAST TEXAS WILDCATS

Fannin County — Failure: Texas Mineral Land Co.'s Wharton 1, 2500 ft nsl and 1060 ft wel of Wm. M. Rice sur, elev 707 ft, Georgetown 1506-2135 ft, Paluxy between 2265-95 ft, Glen Rose 2752 ft, anhydrite 3125-3224 ft, Ouchita 3210 ft, jkd in Paleozoics 4100 ft.

Kaufman County — Failure: Thos. D. Humphrey et al's Wimpee 1, 330 ft ewl and 850 ft snl of C. Williams sur, elev 416 ft, base Austin 2760 ft, Woodbine sand 3201 ft, abnd 3332 ft.

Nacogdoches County—Failure: Roberts Oil Co.'s Rambin 1, 842 ft wel and 3075 ft snl John Simpson sur, elev 360 ft, abnd 1660 ft.

Rains County—Failure: C. H. Marshall, tr's Gaston 1, 660 ft out sec 229½-ac lease and James Garrett sur, elev 473 ft, top Pecan between 2100-50 ft, top Austin between 2950-3050 ft, jkd 6200 ft.

Robertson County—Failure: W. H. Doran et al's Fogle-Woodall 1, 1850 ft wel and 330 ft nsl of 1200-ac tr, L. Purdy sur, abnd 1644 ft.

Titus County—Failure: R. L. Peveto and J. B. Stephens' Farrar-Magnolia 1, 330 ft out swc of west 100 ac of 200-ac tract, J. M. Nugent sur, elev 313 ft, Woodbine 3195 ft, Georgetown 3783 ft, abnd 3803 ft.

NORTH TEXAS WILDCATS

Archer County—Failures: Geo. W. Cooper-Alex Goldsmith's Kempner 1, se se sw S.P. Ry.-KWVFL sec 5, blk A-418, KMA lime 3918 ft, Bend 4240 ft, Ellenburger 4629 ft, abnd 4669 ft.

Fortex Oil Corp.'s Wilson 1, 1320 ft n and 330 ft w of nec ATNCL sec 100, but in subdiv 206, Geraldine Townsite subdiv, abnd 1600 ft.

Geo. Proctor et al's Powell 1, 1200 ft s and 450 ft w of nwc sec 55, blk 5, Clark-Plumb sur, but in H. A. Allen sur A-3, abnd 1349 ft.

Staley Oil Co.'s Colgan 1, 2190 ft ewl and 1476 ft nsl of 240-ac lse in D. A. Murdock sur A-284, abnd 1500 ft.

White & Duncan's Richardson Est. 2-C, 1030 ft nsl and 660 ft wel blk 10, J. Scott sur A-374, abnd 1249 ft.

Cook County—Failure: Texas Co.'s McGeorge 1, 330 ft out swc lse, or 500 ft s and 200 ft e of swc of J. Campbell sur, in Hiram Walker sur A-1082, elev 813 ft, Ellenburger 3600 ft, abnd 3838 ft.

Jack County — Oil Discovery: Hanlon & Buchanan, Inc.'s Matlock 1, 467 ft out swc of 50-ac lease and A. H. Latimer sur A-363, se edge of East Bryson field's Strawn production, elev 1228 ft, Palo Pinto 1034 ft, Bend 4434 ft, Marble Falls 4918 ft, Mississippian 5311 ft, flow 273 bbls, gas-oil ratio 1750/1, ¼-in choke, cp 1850-1630 ft, tp 1140 lbs, acid 1000 gals Mississippian 5316-44 ft.

Throckmorton County—Failure: Bridwell Oil Co.'s Richards 1, 2595 ft n and 3388 ft w of m/s/se cor of Andrew J. Morgan sur A-226, abnd 1969 ft.

Young County—Failure: Rathke Oil Co.'s Johnson 2-B, 2533 ft ewl and 1370 ft snl of H. F. Young sur A-1286, elev 1125 ft, Marble Falls 4223 ft, Barnett 4568 to 4650 ft, Mississippi 4650 ft, Ellenburger 4775 ft, abnd 4900 ft.

WYOMING WILDCAT

Albany County—Discovery: Oklahoma Oil Co.'s Union Pacific 1, c ne nw 7-15n-75w, North Big Hollow district, swab 6 bph 22°, Muddy 827-848 ft, est 65 bpd rate, td 848 ft.

United States Wildcat Starts

COLORADO

Archuleta County: L. R. Travis, Davis 1, sw sw ne 18-33n-1e, Boone dome, Dakota test, lcn.

Malco Refineries, Inc., Fitzhugh 1, sw se ne 3-32n-1e, Chromo district, dr 650 ft Dakota test.

FLORIDA

Madison County: Hunt Oil Co.'s J. W. Gibson 3, 528 ft fr s & w ls sect 18-2s-11e, lcn.

ILLINOIS

Bond County: Union Products Pet. Co.'s Accornero 1, ne nw ne 26-4n-4w, lcn.

Cole County: H. V. Daugherty et al's Clark 1, ne sw nw 32-12n-8e, lcn.

Effingham County: H. Sherman et al's Niemerg 1, sw sw sw 16-7n-7e, lcn.

Hamilton County: Reward Oil Co.'s Walker 1, se nw nw 13-6s-7e, drlg.

Jasper County: Pure's Arnold 1, ne ne ne 14-6n-10e, lcn.

Montgomery County: Walter Vette's Ware 1, ne nw 15-9n-4w, lcn.

INDIANA

Jefferson County: W. A. Copeland's Free 2, sw nw 9-4n-9e, drlg.

Newton County: C. R. Hutchison's Trachel 1, sw nw 22-27n-8w, lcn.

Warrick County: Eureka Oil's Helms 1, sw sw nw 23-6s-8w, lcn.

KANSAS

Barton County: Maguire Industries' Logan 1, se nw nw 35-16s-14w, lcn.

Bridgeport's Liebl 1, nwc nw 16-18s-11w, lcn.

Butler County: E. S. Adkins' Taylor 1, nw nw ne 17-27s-4e, drlg 2125 ft.

Ellis County: Carter's Matheson 1, cse sw 24-11s-16w, lcn.

J. M. Huber et al's Olson 1, swc se 18-11s-20w, lcn.

Graham County: Sunray's Dunwoody 1, sec sw 2-8s-22w, lcn.

Greenwood County: J. E. Morris et al's Fisher 1, se se ne 31-24s-10e, drlg 450 ft.

Pratt County: Skelly's Moore 1, ne se ne 6-29s-13w, lcn.

Rice County: Skelly's Ruhl 1, ne se nw 17-18s-9w, lcn.

Rooks County: Sinclair Prairie's Fry 1, swc nw 25-6s-17w, lcn.

Stafford County: Sinclair Prairie's Harter 1, sw nw sw 31-24s-13w, lcn.

Sumner County: Darby & Bothwell's Freeman 1, nwc nw 29-32s-3w, lcn.

Trego County: Texas Co.'s Roberts 1, sw sw se 4-12s-22w, lcn.

KENTUCKY

Daviess County: Miller & Shiarella's Payne 3, 18-O-27, lcn.

Webster County: Sinclair Prairie's Withers 1, 8-M-24, lcn.

Sinclair Prairie's Crawley 1, 13-N-23, lcn.

NORTH LOUISIANA

De Soto Parish: Mrs. Q. M. McCullough's Kavanaugh 1, 330 fr wl se¼ 18-11n-11w, lcn 3000-ft test.

Morehouse Parish: Texas Co.'s Susie R. Kennedy 1, c sw se 32-22n-6e, lcn 6800-ft or Smackover test.

Natchitoches Parish: The California Co.'s Annie Morrison 1, 654 fr el ne¼ 12-13n-8w, lcn 5000-ft test.

SOUTH LOUISIANA

Acadia Parish: Continental Oil Co.'s Mrs. L. D. Thibodeaux 1, Church Point area, 330 ft out of ne cor sect 73-7s-2e, lcn 9500-ft test.

Cameron Parish: Amerada Pet. Corp.'s Glassell 2, 2000 ft s & 2200 ft e of USCGS monument "Mallard" in Mallard Bay T-13s-3w, lcn 10,000-ft test.

Lafourche Parish: The Atlantic Refining Co.'s Bowie Lumber Co. 1, Kraemer area, 660 ft s & 1980 ft e of nw cor sect 7-14s-18e, 12,000-ft test lcn.

St. Mary Parish: Hunt Oil Co.'s St. Mary Bank & Trust Co. 1, ne cor sect 8-15s-12e, beg at necor sect go s 10 deg 31 min w 551.1 ft, thence s 62 deg 15 min w 900 ft to lcn for 13,000-ft test.

MICHIGAN

Allegan County: C. W. Cook's Thomas 1, ne ne nw 20-2n-13w, rig.
Harris Oil Co.'s Berens 1, se se nw 19-4n-13w, lcn.
Kent County: Oil Producers, Inc.'s Raymer 1, sw sw sw 14-5n-11w, rig.
Mecosta County: Michigan Consolidated Gas Co.'s Evans 1, nw se sw 12-15n-8w, lcn.
Montcalm County: Southwest Development Co.'s Noll 1, ne ne se 31-10n-5w, rig.
Ottawa County: Rex Oil & Gas Co.'s Huizenga 1, sw se nw 24-5n-15w, dr.

MISSISSIPPI

Atalla County: Erle P. Halliburton, Inc.'s C. S. Hester 1, cent ne nw ne sect 28-14n-5e, lcn for 6000-ft test.
Claiborne County: Danciger Oil & Refining Co.'s Claude Taylor 1, 660 ft fr nl of sect 51 & 495 ft fr el of sect 62, in sect 51-13n-3e, lcn for Tuscaloosa test.
Copiah County: Arkansas Fuel Oil Co.'s J. H. Caraway 1, 580 ft fr sl & 608 ft fr wl of sect 15-1n-3w, lcn for 11,000-ft test.
Forrest County: Harry I. Morgan & Dillworth Hager's United States of America 1, cent sw nw sect 2-1s-12w, lcn for Lower Cretaceous test.
Issaquena County: The California Co.'s Mississippi Alluvial Farms 1, 660 ft fr nl & 665 ft fr el of se¼ sect 34-12n-8w, lcn.
Webster County: Webster County Oil & Development Trust's State 1, 330 ft fr n & e lines of sw sect 15-21n-8e, lcn.
Yazoo County: Sinclair-Wyoming Oil Co.'s O. C. Ingram 1, cent ne sw sect 17-21n-8e, lcn for Tuscaloosa test.

MISSOURI

Stoddard County: H. M. Marr et al's Barnett 1, csw sw 3-25n-11e, drlg 500 ft.

MONTANA

Liberty County: R. C. Tarrant's Pugsley 1, nw nw nw 24-28n-4e, Basin Coulee area, lcn.
Teton County: Texas Co.'s Olvohde 1, nw ne sw 8-28n-2w, Sterrenberg blk, lcn.

NEBRASKA

Richardson County: L. M. Bates et al's Fritz 1, se se se 34-3s-15e, lcn.

NEW MEXICO

Eddy County: Brown et al's Shildneck 1, se sw se 28-20s-25e, lcn 800-ft test.
A. J. Hardendorf et al's Geo. Riggs 1, nw ne se 7-20s-30e, mim.
Lea County: The Texas Co.'s John S. Eaves 1, c se ne 26-16s-38e, lcn San Andres test.

OKLAHOMA

Garfield County: E. S. Adkins' School 1, nw ne nw 36-21n-4w, drlg 520 ft.
Greer County: E. K. McLennen's McLeod 1, sw nw nw 32-6n-21w, machine.
Lincoln County: R. M. Tate's Sukovaty 1, sw sw se 15-14n-3e, mit.
Logan County: F. C. Hall's Perdue 1, se se sw 24-19n-4w, rig.
Osage County: Sinclair Prairie's Osage 1, ne ne se 31-25n-6e, rur.
Stephens County: Skelly's Chilton-Mayo Unit 1, ne nw se 31-2s-4w, lcn.

WEST TEXAS

Andrews County: Stanolind's University 1-P, c ne ne sec 44, blk 13, 3¼ mi s by e of Fullerton field's deep well, lcn 7500-ft test.
Cochran County: Helmerich & Payne, Inc.'s D. S. Wright 1-A, 660 ft out swc lab 14, leag 98, Brewster CSL sur, 3 mi nw production, lcn 6500-ft test.
Pratt-Hewitt Oil Corp.'s Dick Slaughter 1, 440 ft out sec lab 13, leag 85, Shackelford CSL sur, lcn 6000-ft Clear Fork test.
Crane County: Gulf's John Edwards 3-B, c ne ne PSL 11, blk B-18, cem surface pipe on 10,000-ft Ellenburger test.
Ector County: Arch Rowan Drilling Co.'s T.P. Land Trust 1, c nw se T&P Ry. 29, blk 43, T-1-S, lcn 9000-ft Silurian test.
Lubbock County: The Norwalk Co.'s Nislar-Sun 1, c nw ne HE&WT Ry. 23, blk AK, lcn 6500-ft Clear Fork test.

WEST TEXAS OUTPOST TEST

Cochran County: Helmerich & Payne, Inc.'s D. S. Wright 1, 660 ft out nec lab 1, leag 95, Mills CSL sur, 1⅜ mi w by s nearest production, lcn 6500-ft Clear Fork test.

SOUTH CENTRAL TEXAS

Bastrop County: Seaboard of Dela.-Shamrock Oil Co.'s Bertha Artmann 1, 467 fr sl 1475 fr wl 748.9-ac lse, Oglesby sur, Paise area, lcn 8500-ft test.

SOUTHWEST TEXAS

Duval County: Cullen-Porter's Jesus V. Ruiz 1, 330 se of nwl 340.8 ne of swl 42.8-ac lse, AS&M sur 36, lcn 4250-ft test.
Cox & Hamon-John O'Neil-J. W. Gorman's Clara Driscoll 2, 990 fr wl 330 fr nl sect 44, Santa Rosalia Gr, 1320 e of No. 1 dry hole, ru.
R. H. Hawn's Leroy Denman 1, 1650 fr el 2310 fr nl sect 21, 640-ac lse, Realitos subdvn of Copita Farm & Garden Tr, lcn 6000-ft test.
Jim Hogg County: Texon Roy. Co.'s Hector Vela 1, 330 fr n&el Jose Teodora Vela sur 108, 1½ mi s Henne-Winch-Farris fld, lcn.
Webb County: Union Prod. Co.'s O. W. Killam 1, 330 fr el 467 fr sl R. Sciarraffa sur, 160-ac lse, lcn 8000-ft test.

LOWER TEXAS COAST

Bee County: W. Earl Rowe's Mrs. Nona B. Davis 1, start sely cor 1000-ac lse go nw alg swl 4500 th ne at ra 1320 to lcn in Bee CSL sur 12, ru and dr wtr well.
Jackson County: Humble's B. Clements et ux 1, 428.8 fr se&nwl 1800 fr swl 80-ac lse, J. J. Linn sur A-213, El Toro area, lcn 7000-ft test.
Seaport Oil Corp.'s Joe Klink 1, 330 fr sw&sel 140-ac lse, and blk 2 Geo. Strake farmout, Ramon Musquez Gr, 1½ mi nw Vanderbilt, lcn 7500-ft test.
Karnes County: Seaboard of Dela.'s Sallye Treadwell 1, 1980 fr nl 660 fr el 646-ac lse, Coy City area, Henry S. Brown sur, lcn 8000-ft test.
Southern Minerals Corp.'s Joe Bartoxch 1, 171-ac lse, Louis Manchaca sur A-5, 1 mi n Falls City, dr 300 ft.
San Patricio County: Sinclair Prairie's Daniel P. Moore 1, 660 fr n&wl ne¼ sect 69, 160-ac lse, G. H. Paul subdvn Colman-Fulton Pstr. Lnds, 5 mi sw Gregory, lcn 7000-ft test, may go to 10,000 ft.
Victoria County: Catahoula O&G Co.'s Mrs. Etta Terrell 1, 330 fr nel 330 fr nl 1000-ac lse, Ed. McDonough sur, elev 100 ft, lcn 5600-ft test.

TEXAS GULF COAST

Colorado County: Sinclair Prairie's Felix Fehrenkamp 1, 5 mi ne of Rock Island, 5050 ft fr nl & 1050 ft fr el of SA&MG RR sur 23, lcn Wilcox test.
Montgomery County: Gulf Oil Corp.'s Foster Lumber Co. C-1, 3½ mi se of Splendora, 15,200 ft e along nl of P. Bryan sur fr intersection of nl with RR, thence 1127 ft s at rt ang, lcn Wilcox test.
Wharton County: The Salt Dome O. Corp.'s H. P. Stockton 1, 600 ft fr el & 500 ft fr sl of J. Finley sur, 5 mi nw of Louise, lcn 6000-ft test.

EAST TEXAS

Camp County: Harry S. Moss et al's Mrs. Nettie Bryson 1, 660 ft out nwc of 319-ac lse, or 1180 ft wel and 660 ft snl Robt. Wyres sur, rig for Travis Peak test.
Falls County: H. C. Cockburn et al's Fee-Dr. Gilliam 1, 250 ft sw of m/e/ne line and 3000 ft nw of m/n/se line of D. Barclay sur.
Henderson County: Humble's R. A. Huddleston 1, 408 ft snl and 830 ft ewl of blk 5, or 5720 ft snl and 830 ft ewl K. H. Douglas sur, 2½ mi se Eustace, mim for Travis Peak test.
Van Zandt County: Lone Star Producing Co.'s J. J. Goode 1, 795 ft from m/e/e and 584 ft from m/n/s lines of 1686-ac lease and D. Rose sur, mim for 7500-ft test.

NORTH TEXAS

Archer County: D. H. Bolin et al's J. Purcell 1, 150 ft wel and 450 ft nsl blk 75, Jefferson CSL sur, lcn 1100-ft test. Chas. E. Morrison and Maguire Industries, Inc.'s McGregor 3, 1470 ft wel and 175 ft nsl blk 4, Coleman subdvn of Brazos CSL sur, lcn 900-ft test.
King County: Shamrock O&G Corp.-Roeser-Pendleton, Inc.'s Masterson 2, 660 ft out sec sec 164, blk A, R. M. Thompson sur A-497, mim for Ellenburger test.
Montague County: The Texas Co.'s L. H. Hutson 1, 660 ft out sec G. W. Fletcher sur A-280, 3500-ft test, dr 428 ft.
Throckmorton County: Bridwell Oil Co.'s Mable Richards 2, 2595 ft nsl and 2585 ft ewl Andrew J. Morgan sur, lcn 600-ft test.
Panhandle Ref. Co. et al's J. W. Thorp 1, 467 ft out sec sec 3007, TE&L Co., lcn 5500-ft. test.

WEST CENTRAL TEXAS

Coleman County: J. L. Collins & Co.'s Morris Miller 1, 1880 ft nsl and 1000 ft ewl sec 16, HT&B Ry. sur, elev 1589 ft, testing 519 ft.
Jones County: Hunt Oil Co.'s T. J. Amason 1, 3528 ft nsl and 2997 ft ewl of Samuel Jones sur 266, mim for 4500-ft cable test.
M. R. Hart et al's T. R. Putnam 1, 330 ft wel and 440 ft snl of 130-ac lse, sec 3, C&M Ry. sur 1, lcn 2000-ft test.
Stephens County: Maguire Industries, Inc's Max Black 1, 1400 ft out nwc TE&L Co. sec 1271, lcn 3400-ft rotary test.

The OIL WEEKLY'S TRADING POST

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■ About 28,000-acre block So. Ga. leases for sale. Send or come and investigate. Owners care box 364, Waycross, Ga.

■ FOR SALE: One Ft. Worth "D" spudder located in Brown County, Texas; also, one complete string of cable tools in excellent condition. Tools may be inspected at Breckenridge, Texas. J. D. Sandefer, Jr., Breckenridge, Texas.

■ One Cardwell Model R, Double Drum Spudder; One Fort Worth Jumbo C spudder. Tools complete and steel dog houses for both. Call 3846 or write Lesh Drilling Company, 210 South Main Street, Henderson, Kentucky.

■ FOR SALE, Complete small gasoline rotary drilling rig $8500. Might consider shallow contracts. 700-acre stock farm for sale with good oil possibilities six miles east of Marquez, Leon Co., $15 acre. A. R. Lewis, Corsicana, Texas.

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■ WANTED: Experienced mechanical designing engineers by company established over fifty years. Increased demand for our products has created need for additional permanent engineering organization. Prefer graduate engineers with practical training in design and use of drilling and other machine products related to petroleum industry. Salary commensurate with experience and ability. State age, education, experience, record by consecutive dates for past ten years, references. No references will be contacted before personal interview. Address: Box 20, c/o The Oil Weekly, Houston, Texas.

HELP WANTED

■ WANTED: Salesmen for cable tool drilling equipment, preferably men with some drilling experience. Salary and commissions with traveling expenses paid. Permanent position. Give age, experience, education and references as well as history of employment for past ten years. No references will be contacted without your authority. Address: Box 21, c/o The Oil Weekly, Houston, Texas.

■ WANTED: Young Engineer for expanding gas department major oil company—chemical, mechanical or petroleum engineering training suitable—prefer some experience in oil or gas production. Fine opportunity for right person. Address: Box 24, c/o The Oil Weekly, Houston, Texas.

■ WANTED: Experienced production superintendent between 30-35 years old, familiar with gas, gas distillate, and oil wells, including dual completions and workovers. Prefer man with engineering training but not necessarily a degree. Address: Box 22, c/o The Oil Weekly, Houston, Texas.

SITUATIONS WANTED

■ Gravity meter party available about November 16th. Address: Box 23, c/o The Oil Weekly, Houston, Texas.

■ PETROLEUM ENGINEER, experience in petroleum production, reservoir studies, plant processing and operation; interested in field or sales engineering. Available November 10. State maximum salary and full particulars. Address: Box 26, c/o The Oil Weekly, Houston, Texas.

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Squeaks from the Bull Wheel

Peculiar People

The sweet young thing washing the windows lost her balance and fell one floor into the garbage can. She sat there disgusted.

A Chinese gentleman passing by paused and remarked: "American people velly wasteful. That woman good for ten years yet."

Introduction

"Who you shovin'?"
"I dunno. What's your name?"

Bad Guess

"So you think you are sane enough to be released from this asylum. Well, if we give you your liberty will you promise to leave women and liquor alone?"
"Of course I will."
"Then you're still crazy."

Poet's Nook

A city and a chorus girl
Are much alike, 'tis true;
A city's built with outskirts;
A chorus girl is, too.

Doing It Backwards

"The meek shall inherit the earth," says a proverb.

But the trouble with most people is that they want to get the earth first and be meek afterward.

Listen Closely

Salesman: "I have a machine here that will tell fresh eggs."
Farmer: "Tell 'em what?"

Naturally

Voice on telephone: "My son has a severe cold and won't be able to come to school today."
Teacher: "Very well, sir. Who is this speaking?"
Voice: "This is my father."

Can't Be Done

Hi diddle, diddle, the cat and the fiddle,
He called the sergeant a goon
The MP's laughed to see such sport,
Court-martial: Tomorrow at noon.

East Meets West

Cowboy: "What kind of a saddle you want—with a horn or without?"
Dude: "Without. There isn't much traffic around here."

The Cure

"Every time I put on a clean shirt I find some buttons missing. What should I do?"
"One of two things—get married or get a divorce."

Husband's Logic

"Papa, does bigamy mean a man has one wife too many?"
"Not necessarily, son. A man can have one wife too many and still not be a bigamist."

Please, Maybe?

Lady (holding a cookie above a dog): "Speak, Fido. Speak?"
Dog: "What'll I say?"

One Man's Excuse

An old and privileged friend asked him why on earth he married a woman with the face of a mournful cow, the brains of an addled sheep and the disposition of a setting hen.

"Well, Joe," he sighed, "it was a truly perfect June night. I'll never forget the scent of honeysuckle wafting across the porch, the softness of the breeze that played with tendrils of her hair, or the sleepy notes of a mocking bird in a nearby bush. But even more unforgettable were the rays of a fat, yellow moon glinting on the barrel of her father's shotgun."

Bryan on High

It is told of William Jennings Bryan that while on a speaking tour of the south he dropped in unexpectedly on an Arkansas hamlet. The villagers had no auditorium and the churches were too small to accommodate the vast crowd that swarmed in to hear the great Democrat. But on the edge of town was a huge pile of manure. Over this they threw tarpaulins and in due course the statesman clambered to the top and looked down upon the natives.

"Ladies and gentlemen," he began in solemn tones, "during my long career in politics I have had many unusual experiences, but none so strange as this. Never did I dream I would ever address a Democratic gathering from a Republican platform!"

An A.A.P.G. Book (1941)
New Printing (1944)
POSSIBLE FUTURE OIL PROVINCES *of the* UNITED STATES AND CANADA
•
Edited by A. I. LEVORSEN
•
The purpose of this symposium is to get an over-all picture of the undiscovered oil resources of North America, north of the Rio Grande. Ten geological organizations have participated, to the end that this survey has behind it the authority of many geologists representing state and national geological surveys, large and small oil companies, and consulting and independent geologists. A map and a section of geology, stratigraphy, and structure illustrate each province description.
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Notes for the Equipment Buyer and User

Variable Speed Drive

LOMBARD GOVERNOR CORPORATION

Lombard Governor Corporation, Ashland, Massachusetts, announces the Lombard variable speed drive for the transmission of power at different speed levels. Because of its compact size and streamlined design, this drive is adaptable to practically every type of variable speed transmission work.

Individually controlled drives for each machine is a forward step in transmission of power, eliminating danger of tie-ups.

The complete unit with the motor has the size and appearance of two standard AC motors coupled together.

Gears of the drive are enclosed and run in oil. Through the gearing arrangement, 90 percent of the power goes through the gears while only 10 percent passes through the V-belt.

Having the variable speed output shaft furnished concentric with the motor shaft is said to give the drive the advantage of a direct line drive. Remote control is also available, with horizontally split casings optional.

Byron Jackson Appoints Rocky Mountain Official

J. B. Buchanan

L. M. Coker

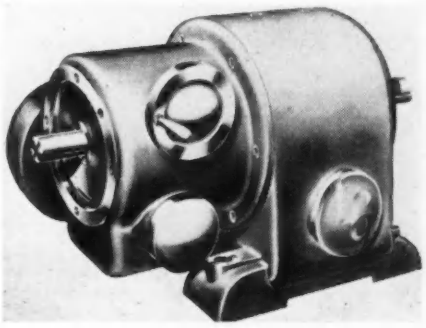
Joel B. Buchanan has been named representative of oil tool division of Byron Jackson, Los Angeles, in the Rocky Mountain territory, with headquarters in Casper, Wyoming. He has been associated with the oil industry for 20 years, in the Mid-Continent, Mexico and South America, as drilling contractor, tool pusher and rig man.

Lawrence M. Coker has also joined the Byron Jackson organization, oil tool division, as export sales engineer. He will handle foreign contacts on the Pacific Coast. He was formerly connected with National Supply Company.

Tire Booklet Issued

The B. F. Goodrich Company, Akron, Ohio, has published a 40-page booklet on treading and repairing tires and tubes.

Treading definitions and terms are shown in a drawing of a tire's cross section and these are then given detailed textual description. Shop tools required for treading operations are listed, and the various steps in preparing the tire for the new tread, applying and vulcanizing it are given.



Lombard Variable Speed Drive

Shell Honored

Shell Oil Company, Incorporated, was awarded the United States Coast Guard Security Shield of Honor in a ceremony at Lake Charles, Louisiana. Lt. Commander Andrew Johansen of the Coast Guard at Port Arthur presented the shield, and E. N. van Duzee, division manager of Shell, accepted on behalf of his company. W. F. Rickards of the Shell company presided.

The award was in recognition of adequate measures taken to prevent sabotage at Shell's Haymark Terminal on the Calcasieu Ship Channel.

Sperry-Sun Rocky Mountain Representative Named

Sperry-Sun Well Surveying Company announces the appointment of Inland Oilfield Service, Inc., as exclusive representative in the Rocky Mountain territory, including North Dakota, South Dakota, Montana, Wyoming, Utah and Colorado, with main office in Casper, Wyoming. Glenn N. English, president of this organization, formerly was superintendent for Manning & Brown, Inc., drilling contractors.

Glenn N. English

Firm Moves Offices

Midwestern Engineers moved into its new quarters November 1, following purchase from Leland Equipment Company of a one-story brick office and warehouse building at 105 North Boulder, Tulsa. The Leland Company has moved to new quarters in the Continental Supply Company building.

WELDING SLEEVES . . .

Another PATTERSON Specialty

The Welding Sleeves which M. F. Hampton Company furnished to the Tennessee Gas & Transmission Line were manufactured by Patterson.

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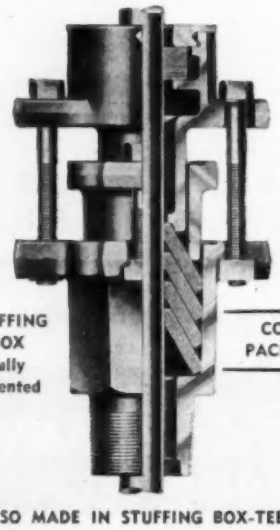

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JOHN GEORGE GOLL, 78, pioneer oil operator of Michigan, died at his home in Saginaw October 21. He was president of the firm of Goll, Graves & Mechling, and had been closely associated with several of the most important oil discoveries in Michigan, including West Branch in Ogemaw County; Porter field, Midland County; and Buckeye, Gladwin County.

JOHN H. JENNINGS has opened consulting engineering offices in the Philtower Building, Tulsa. He was employed in the Rocky Mountain area with Mountain Fuel Supply Company before going to California with Ohio Oil Company. Previously he was associated with Sunray Oil Corporation, Tulsa.

PAUL L. HENDERSON, Houston division geologist for the Ohio Oil Company, has been promoted to chief geologist with headquarters at Findlay, Ohio. W. C. Kinkel, Midland, Texas, district geologist, succeeds Henderson at Houston and the former was relieved by Hugh Tanner, who has been in charge of New Mexico operations with office at Hobbs.

GEORGE R. GIBSON, West Texas division geologist for the Richfield Oil Corporation, was elected president of the Midland (Texas) Geological Society, succeeding Tom W. Koch. Leo J. Newfarmer, Shell Oil Corporation, and John J. Hill, Union Oil Company of California, were chosen vice president and secretary- treasurer, respectively.

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